PATIENT, AGENCY, AND AREA CHARACTERISTICS ASSOCIATED WITH REGIONAL VARIATION IN THE USE OF MEDICARE HOME HEALTH SERVICES

September 30, 1994

Author:

Jennifer Schore

ACKNOWLEDGMENTS

CONTENTS

CONTENTS *(continued)*

TABLES

EXHIBITS

EXECUTIVE SUMMARY

Over the past 10 years, growth in the use of the Medicare home health benefit has increased disproportionately to other sectors of the Medicare budget. Some of this growth was in response to the increased need for home health to provide postacute care in the wake of prospective payment for inpatient services in the early 1980s. Additional growth occurred as home health became more widely available, following the clarifications of Medicare regulations in response to the Duggan v. Bowen lawsuit in the late 1980s. Nonetheless, the extraordinary increase in the use of the benefit and the growth of home health as an industry have caught the attention of policymakers. Moreover, striking regional variation in the levels of care that home health patients received leads to questions about whether more home health care than appropriate is provided in some areas and less care than appropriate in others.

OVERVIEW OF THE STUDY

In this study we begin to address two questions: (1) Why does the use of home health care vary so widely across regions? and (2) Is there a corresponding variation across regions in patient outcomes suggesting that lower levels of care lead to poorer outcomes for patients or higher levels lead to improved outcomes?

The database for this study was based on a 25-percent random sample of beneficiaries identified from those who had claims on Medicare's 1990, 1991, or 1992 40 Percent Home Health Bill Records files. The unit of observation for the study was a home health episode. A standard definition of episode was used to overcome agency differences in admission and discharge practices. Episodes of home health care were defined as periods covered by strings of consecutive Medicare claims for home health services that were preceded and followed by at least a 30-day hiatus in claims. We merged data describing the home health episodes with data from a variety of Health Care Financing Administration files and the Area Resource File to describe patients prior to, during, and immediately following episodes; the agencies providing care; and the service environments of counties where the agencies were located.

The study database consisted of 634,844 home health episodes that started in 1990, 1991, and 1992. However, analysis of home health use--visits rendered per episode and episode length--was based on the 398,522 episodes that started in 1990 and 1991. Measures of home health use that included episodes that started in 1992, particularly late 1992, would have been subject to a high degree of truncation.

This study has a number of limitations. To begin with, secondary data, such as those used in this study are limited because they provide only crude descriptions of home health patients, agencies, and service environments. Many factors affecting home health use can be measured only with primary data, if at all (for example, patient compliance with prescribed treatments, and availability and capability of informal caregivers). Data on other factors, such as county-level home health capacity or the availability of home- and community-based services, would have enhanced the database but were not readily available. Second, the study must be viewed as preliminary because it can only identify associations between home health use, potential patient outcomes, and characteristics. From these associations, we can conjecture about the causes of regional variation but cannot determine the specific reasons underlying regional variation. Finally, the study is particularly tentative in its

conclusions regarding patient outcomes, because it is not possible to label an outcome measure based on secondary data as necessarily adverse or as having resulted directly from home health care. A hospital admission shortly after a home health episode could reflect either an appropriate decision on the part of the agency to move a patient to a higher level of care or poor-quality home health care. Moreover, such a hospitalization could be totally unrelated to the care provided by the home health agency (for example, if the patient was not complying with treatment recommendations, despite the agency's best efforts). Thus, a higher incidence of "adverse" outcomes in areas with fewer visits per episode may reflect unmeasured differences in patient or area characteristics.

Despite these caveats, this analysis provides some insights into the extent and sources of regional variation in Medicare home health use and potentially related patient outcomes.

CHARACTERISTICS OF HOME HEALTH EPISODES

Overall, the mean number of visits rendered during Medicare-covered episodes that started in 1990 or 1991 was 47 and the mean episode length was 94 days. Of those 47 visits, 64 percent were provided by skilled nurses, 20 percent by home health aides, 15 percent by therapists (primarily physical therapists), and only 1 percent by medical social workers.

Consistent with earlier studies, we found a threefold difference in the (nonregression-adjusted) use of Medicare home health services between the East South Central region of the United States (Alabama, Kentucky, Mississippi, and Tennessee), where episodes included 95 visits and were 180 days long, on average, and the Pacific region (Alaska, California, Hawaii, Oregon, and Washington), where episodes included 28 visits and were 60 days long, on average. Home health use was also markedly higher than average in the West South Central region (Arkansas, Louisiana, Oklahoma, and Texas) and markedly lower in the Middle Atlantic region (New Jersey, New York, and Pennsylvania).

Home health users in the two South Central regions emerge as patients with long-term needs. Their study home health episodes were much longer than average, and they had greater numbers of home health visits during the six months prior to study episodes. They also were more likely to have new episodes within 31 to 60 days following study episodes. Patients in both South Central regions were much more likely to have a principal diagnosis of diabetes or of hypertension or another cerebrovascular condition; patients in the East South Central region (which had the higher home health use of the two regions) were also more likely to be incontinent or to suffer from malnutrition or dyspnea. Patients in both regions were more likely to have venipuncture on their initial treatment plans, indicating that they were too frail or lacked the support to leave home for routine blood tests. Thus, these patients emerge as chronically ill, frail, and in poor health. This picture is underscored by their somewhat above-average use of home health aide services and their higher rates of mortality and hospital admission following home health.

A very different profile emerges of home health patients in the Middle Atlantic and Pacific regions, where home health use was lowest. Patients in the Middle Atlantic region were more likely to use home health as postacute care, having entered home health within two weeks of a hospitalization; they also spent an above-average number of days in the hospital during the six months prior to home health. Patients of agencies in the Middle Atlantic and Pacific regions tended to be less likely to have diabetes or incontinence and were much less likely to have venipuncture in their treatment plans. Patients in the Pacific region received much more rehabilitative care and many more medical social services during home health than patients elsewhere. Patients in both regions had somewhat below-average rates of mortality and home health readmission following study episodes.

Thus, patients in these regions emerge as less frail and less chronically ill than their counterparts in the South Central regions.

Patients in the South Central regions were served by home health agencies that tended to be located in nonmetropolitan areas and areas with above-average levels of poverty, particularly among the elderly. Services that might serve as alternatives to home health are likely to be in short supply in such areas. The agencies serving them were largely freestanding and proprietary.

Patients in the Middle Atlantic and Pacific regions were served by agencies that tended to be located in large metropolitan areas and areas in which elderly residents had relatively higher incomes. Services that might serve as alternatives to home health may be more plentiful in these areas. The agencies serving them tended to be nonprofit. In the Middle Atlantic region, the majority of agencies were Visiting Nurse Associations, while in the Pacific region the majority were hospital based.

A multivariate model of visits rendered per episode (controlling for patient, area, and agency characteristics) showed that a number of the characteristics distinguishing episodes in the high- and low-use regions were also associated with a statistically significant *increase* in visits of 10 percent or more (over the mean of 47 visits):

- *Patient Characteristics*. Being nonwhite; having a principal diagnosis of serious neuromuscular or degenerative disease, stroke, anemia, malnutrition or dehydration, peripheral vascular disease, a urinary-tract disorder (including incontinence), or a complicated wound (relative to having a diagnosis of diabetes); having a secondary diagnosis of incontinence or neurological disease; and having had more than three home health visits during the six months prior to the study episode

- *Area Characteristics*. Receiving care from a home health agency located in a smaller metropolitan county (one with a population of less than 250,000) or an urbanized nonmetropolitan county (one in which 20,000 or more residents commuted to urban areas), rather than from an agency in a core county of a metropolitan area with a population of at least one million

- *Agency Characteristics*. Receiving care from a proprietary agency (relative to a nonprofit)

Controlling for patient, area, and agency characteristics reduced the standard deviation of mean visits per episode across regions by about one-third (from 21 visits for unadjusted regional means to 14 visits for regression-adjusted means).

Even after regression adjustment, however, the East South Central region still had the highest levels of home health use, and the Pacific and Middle Atlantic regions still had the lowest. These regions maintained their above- or below-average use levels even when separate analyses were carried out on three subsamples of episodes for which patients had the same general principal diagnosis (diabetes, serious cardiopulmonary disorders, and stroke/serious neuromuscular disorders) at episode start. Moreover, region-specific models of home health use indicated that roughly the same patient characteristics were associated with increased use overall as were associated with increased use in individual regions. This suggests that the large regional differences in home health use do not result from gross differences in agency practice for a few specific conditions or types of patients.

Although our ability to assess the contribution of fiscal intermediary (FI) practice to regional variation was limited to bivariate analysis by the high correlation between region and FI assignment, our data suggest that FI practice did not play a major role in the variation of home health use. This assessment is based on the observation that average visits per episode and episode length are reasonably consistent across FIs within a region. For example, mean visits per episode and episode length are almost always well above average in the East South Central region, regardless of which FI processed the claims.

Thus, while secondary data explained a substantial portion of regional variation, other factors, such as medical practice patterns, the supply of home- and community-based and residential alternatives to home health, and patient characteristics that are difficult to measure (for example, compliance with recommended treatment regimens, functional status, availability of informal care, and preferences for informal versus formal or community-based versus residential care) must explain most of the variation.

CLAIMS-BASED PATIENT OUTCOMES POTENTIALLY RELATED TO HOME HEALTH

We found that home health patients in the low-use Pacific region had among the lowest rates of home health readmission, inpatient admission, and mortality during the period immediately following study episodes, while patients in the high-use East South Central region had among the highest. (Similarly, the Middle Atlantic region exhibited lower rates for most patient outcomes, while the West South Central region exhibited higher rates.) Thus, differences in these patient outcomes for the high- and low-use regions lead us to reject the hypothesis that low levels of home health care lead to poorer patient outcomes (or vice versa). The regional differences in outcomes likely reflect the relative pre-episode health of home health patients.

CONCLUSIONS

We conclude that home health agencies in the highest-use regions are not overproviding care. Rather, they are probably providing appropriately higher levels of service in response to the needs of very frail patients who may have access to relatively few alternative sources of care and few resources to purchase those available. It seems likely that home- and community-based and residential sources of care that could serve as alternatives to the long-term use of the Medicare home health benefit may be quite limited in this region. Thus, home health agencies in the region may serve patients for as long as is justifiable.

By contrast, agencies in low-use regions such as the Pacific serve much less frail and chronically ill Medicare beneficiaries who may have better access to alternative sources of care. Furthermore, our data suggest that the low levels of home health service delivered in the Pacific region did not lead to poorer patient outcomes (for those outcomes we measured).

RECOMMENDATIONS

Characteristics of patients and areas clearly differ between the regions with the highest and lowest use of Medicare home health services. Because of differences in the frailty and health status of home health patients in the East South Central and Pacific regions, we speculate that (1) many of the Pacific counterparts of the frail home health patients in the East South Central region never

enter home health because they are served in other settings or by other programs, and (2) those beneficiaries who do enter home health move to other settings or programs when their pressing skilled needs end.

We recommend that future research examine: to what extent the availability of services that may substitute for ongoing home health care accounts for the regional differences in home health use we observed; whether such alternate care would be cost-effective if implemented more widely in regions of the country with the highest home health use; and whether it is feasible to implement such care in these regions. Alternate services include both home and community-based services (for example, personal care, housekeeping, home-delivered meals, and transportation) and residential services (for example, nursing homes, assisted-living facilities, and foster care).

Because the bulk of regional variation in home health use was *not explained* by the available secondary data, however, future research must also focus on the extent to which differences in agency and physician practice patterns and patient characteristics (other than those described by our data) explain the variation.

The models estimated to explore regional variation also suggested that proprietary agencies provide substantially more visits per episode than do nonprofit agencies, regardless of region. It would be useful to determine why this occurs. Are proprietary agencies more likely to be located in areas with high proportions of frail beneficiaries? Do proprietary agencies employ more home health aides, filling a need for ongoing care of frail patients? Or do they simply provide more care than nonprofit agencies because it is financially advantageous?

The Medicare home health benefit has been evolving incrementally along a continuum toward long-term care in both policy and practice. In some cases, home health may be appropriate long-term care. In others, less costly care may exist that is at least as effective for delivering long-term care. As the need for long-term care increases in the coming decades, the importance of increasing the pool of knowledge surrounding these questions grows commensurately.

I. TRENDS IN RECENT MEDICARE HOME HEALTH GROWTH

Expenditures for Medicare's home health benefit have recently exhibited increased growth disproportionate to other Medicare services. This growth has aroused substantial concern over cost control, particularly if the trend in the benefit continues to broaden, rather than to restrict, coverage. Moreover, the amount of home health services delivered to home health patients has not been uniform across the country, but is higher in areas of the South and lower in areas of the West. Two questions arise naturally from these differences: (1) Why does the variation exist? and (2) Does it affect outcomes for home health patients? This study begins to address these two questions and identifies correlates of regional variation that may assist policymakers in developing cost-control strategies for the home health benefit.

A. MEDICARE HOME HEALTH: WHY ALL THE INTEREST NOW?

In 1990 Medicare spent $3.7 billion on its home health benefit, a modest 3.7 percent of total Medicare spending (Helbing et al. 1993). This relatively small percentage, however, was a sixfold increase in spending over 1980. Moreover, Medicare home health spending reached $9.7 billion in 1993 (U.S. Department of Health and Human Services 1994) and is expected to reach $22.5 billion by 1999 (Vladeck 1994).

Growth in Medicare home health spending between 1980 and 1993 has resulted primarily from increased use rather than rising cost per visit. Three times as many beneficiaries used home health in 1993 as in 1980. (See Table I.1.) Growth in users reflects a 132 percent increase in the proportion of beneficiaries using home health, as well as a 29 percent increase in the Medicare rolls. The growth in users was accompanied by an increase of nearly 150 percent in the number of visits provided per user. Cost per visit rendered also increased, from $33 in 1980 to $81 in 1993. However, Bishop and Skwara (1993) found that most of the increase in cost per visit between 1986 and 1991 could be attributed to inflation, particularly inflation for medical services in general. Thus, increased

1

Medicare home health spending, net of inflation, was likely due almost entirely to the provision of more services to more beneficiaries, not to rising costs.

TABLE I.1

MEDICARE HOME HEALTH USE AND EXPENDITURES FROM 1980 TO 1993

	1980	1985	1990	1993
Medicare Expenditures on Home Health (Dollars)	662 million	1,773 million	3,714 million	9,726 million
Percentage of Total Medicare Expenditures	2.0	2.8	3.7	NA
Number of Beneficiaries Using Home Health	957,400	1,588,600	1,967,100	2,874,100
Percentage of All Medicare Beneficiaries	3.4	5.1	5.7	7.9
Average Number of Visits Provided per Home Health User	23	25	36	57
Average Charge per Visit Provided (Dollars)	33	51	69	81

SOURCE: Helbing et al. (1993) for 1980, 1985, and 1990 statistics; personal communication with HCFA Office of Research and Demonstration staff for 1993 statistics.

NA = not available.

Evolution of the definition of the home health benefit has played a key role in the increase in its use. Since the benefit's inception in 1965, coverage regulations have reflected a shift away from the view of home health as providing strictly limited, posthospital care to providing home-based acute care more generally and later to providing ongoing care for certain chronic conditions. The original home health benefit required a prior hospitalization of at least 3 days and had a limit of 100 visits per year. These restrictions were eliminated by the Omnibus Reconciliation Act (ORA) of 1980, signaling the first departure from the view of the benefit as short-term postacute care.

The implementation of Medicare inpatient prospective payment in 1983 was expected to lead to a major increase in the use of home health (and other postacute services), as patients were discharged from the hospital more quickly and when less medically stable. However, events of the mid-1980s seemed to have averted the expected increase, at least temporarily. In 1981 (and again

in 1986), the General Accounting Office (GAO) issued reports criticizing the Health Care Financing Administration's (HCFA's) home health intermediaries for paying claims that did not meet coverage conditions and for lacking consistency in coverage determination. To meet these criticisms, the Deficit Reduction Act (DEFRA) of 1984 reduced the number of intermediaries processing home health claims, and HCFA retrained the intermediaries to promote consistency in review. HCFA also instructed the intermediaries to increase the number of claims receiving medical review prior to payment. Increased review on the part of intermediaries increased the claim denial rate from 2.5 percent in 1984 to 7.9 percent in 1987 (Helbing et al. 1993).

The high denial rates led to a lawsuit (Duggan *v.* Bowen, in 1988) that ultimately opened the way for more liberal interpretation of benefit coverage requirements. As a result of the suit, HCFA clarified home health regulations in 1988 and 1989. The allowed frequency of home health visits was stated explicitly to provide "part-time *or* intermittent care," rather than "part-time *and* intermittent care"; intermediaries could no longer deny coverage solely on the basis of a patient's chronic disease or need for long-term care, if the patient also had skilled needs; patients could qualify for skilled observation by a nurse or therapist if there was a reasonable potential for complications or need to change treatment; and management of a care plan by a nurse or therapist for certain complex unskilled care cases was included among covered services.

These clarifications were published by mid-1989, but a material increase in benefit use probably did not occur until 1991, perhaps because many home health agencies were slow to implement the changes or continued to operate under the legacy of the high denial rates of the late 1980s. It is likely that we are only now starting to see the full effect of both inpatient prospective payment and the recently clarified home health benefit regulations.

In addition to the evolution of the home health benefit itself, the emerging ability of agencies to provide high-technology care at home has contributed to the number of users and intensity of the home health services they require. The availability of home-based "high-tech" services (such as

3

infusion therapy and the provision of parenteral nutrition, enterostomal care, and ventilator care) has introduced patients to home health who formerly would have received care in an institution. Moreover, since high-tech services are relatively labor intensive, recipients require longer visits for such care.

The home health industry has experienced tremendous growth since 1980. This growth may be viewed as a cause, as well as an effect, of the increased use of the Medicare home health benefit. In 1980, there were 2,924 Medicare-certified home health agencies, of which just 165 (6 percent) were proprietary (Helbing et al. 1993).[1] At the end of 1993, there were 7,000 certified agencies, of which 3,101 (44 percent) were proprietary (personal communication with HCFA staff). This represents more than a twofold increase in the number of all types of certified agencies and nearly a twentyfold increase in the number of proprietary agencies. The influx of new agencies has greatly increased competition in the home health market. The evaluators of Medicare's Home Health Prospective Payment demonstration noted that, in the early 1990s, market pressures to control costs far outweighed the demonstration's incentives for cost control (Thornton et al. 1993). The surge in the supply of home health agencies since 1980, particularly proprietary agencies, supports the notion that home health has become big business.

B. HOME HEALTH USE VARIES BY GEOGRAPHIC REGION

Not only has the use of and spending for Medicare home health been growing faster than almost any other sector of Medicare services (Helbing 1993), but the amount of care rendered to home health patients has exhibited marked variation across geographic regions. For example, among home health episodes that started in 1990 and 1991, the mean number of visits per episode varied from 25 in the western states to approximately 50 in the southern and southwestern states. Similarly, episodes averaged 50 days in the western states, compared with 100 days in the southern and southwestern

---

[1]For the first time, ORA 1980 allowed proprietary agencies to become Medicare certified in states without licensing requirements.

4

states (Schore et al. 1993). Helbing et al. (1993) noted that, in 1990, 47 visits were rendered per person served in the South, compared with 26 in the West. Bishop and Skwara (1993) found similar differences for 1991.[2]

Given the concern over the fast-paced growth of Medicare home health and the observation that the benefit is used differentially across regions of the country, an investigation of the sources of the variation may shed light on strategies for cost control. If shorter episodes and fewer visits do not lead to a higher incidence of adverse outcomes for beneficiaries, public savings might be generated by developing practice guidelines and incentives for agencies in high-use regions to reduce unneeded care. On the other hand, if shorter episodes and fewer visits lead to a higher incidence of adverse outcomes, it is important to identify the minimum amount of care needed to prevent adverse outcomes and to eliminate the need for their subsequent treatment.

C. FACTORS UNDERLYING REGIONAL VARIATION IN HOME HEALTH USE

The observed regional differences in Medicare home health use may stem from regional differences among a number of factors. These factors include patient characteristics, the capacity of home health agencies to provide care, the supply of services that could be used as alternatives to home health, inconsistency in the interpretation of home health regulations by intermediaries, and home health agency and physician practice patterns.

---

[2]These regional differences in home health service use—which approach 100 percent—are large compared with differences in hospital length of stay. They are also similar to recently reported cross-city differences in physician reimbursement. For example, data from the 1990 American Hospital Association survey show hospital length of stay varied from 6.1 days in the Pacific states to 8.7 days in the Middle Atlantic states, a difference of only 43 percent (American Hospital Association 1991). A review of 1989 Medicare claims for physicians' services in the 25 largest metropolitan statistical areas found average reimbursement per beneficiary varied from $872 in San Francisco to $1,874 in Miami, a difference of 115 percent (Welch et al. 1993).

1. Differences in Patient Characteristics

A variety of patient characteristics can affect the use of home health services. The frequency, duration, and type home health care rendered is affected not only by a patient's medical condition, severity of illness, and level of debilitation, but also by factors such as the willingness and ability of the patient (or informal caregiver) to learn and take over the provision of medical treatment and personal care, the compliance of the patient with a prescribed plan of care (including diet, medication, or exercise regimens), and the social, psychological, and economic environment in which the patient lives.

Several studies have attempted to quantify the relationship between patient characteristics and home health resource consumption with the goal of developing a case-mix adjustor to pay prospectively for a spell of home health care. These studies have identified a diverse set of factors associated with high resource consumption:

- The *need for certain types of home health care*, such as skilled wound or diabetic care, care plan management and evaluation, and personal care (Phillips et al. 1992); the administration of intravenous fluids, care of serious decubiti, and extensive rehabilitation (Branch and Goldberg 1993); and the number of treatments planned at admission and a subjective estimate by agency staff of future resource needs (Smith et al. 1992)

- *Specific medical conditions*, such as chronic illness (like diabetes or hypertension), acute serious medical conditions (like cancer or hip fracture), and conditions that lead to neurological impairment (Manton and Hausner 1987); and body system groupings, including gastrointestinal, hepatic, pancreatic, and urinary-tract disorders and disorders of male genitalia (Smith et al. 1992)

- *Acuity or medical stability*, as reflected by the level of inpatient and home health use in the months prior to the home health episode (Phillips et al. 1992)

2. Differences in Service Supply

The supply of home health services and care that may be viewed as an alternative or complement to home health services will affect the use of home health care. Accessibility to home health care is likely to be a problem in areas with few agencies, or with severe shortages of nurses or therapists trained to work with the elderly in a home setting. For example, Kenney (1993) found rural

6

beneficiaries to be 14 percent less likely than their urban counterparts to use Medicare home health services because (1) there are fewer agencies per square mile in rural areas, and (2) rural agencies offer a much narrower range of services. A Prospective Payment Assessment Commission (ProPAC) report describing Medicare home health use in 1991 found the ratio of Medicare-certified agencies to elderly persons varied tenfold across states, although the report noted that the ratio alone did not reflect the actual capacity of agencies to deliver care (Prospective Payment Assessment Commission 1993).

The availability of alternatives to Medicare home health care or care that complements home health (such as personal care or home-delivered meals) will also affect the extent to which home health is utilized. For example, if nursing home beds are scarce, beneficiaries are more likely to use home health care (either while awaiting nursing home placement or instead of nursing home placement).[3] Similarly, if hospitals have very high occupancy rates, they may be inclined to discharge patients sooner and with greater posthospital home health needs than otherwise. Beneficiaries living in areas with a good supply of home- and community-based support programs (such as those funded by the Older Americans Act or Medicaid home- and community-based waiver programs) may be less likely to use Medicare home health or may use a different skill mix of home health professionals.

3. Differences in Intermediary Practice

DEFRA 1984 directed that the number of intermediaries be reduced from 47 to not more than 10 regional home health intermediaries "in order to provide greater consistency, uniformity, and expertise in the review of HHA [home health agency] claims" (Helbing et al. 1993). Even following this change, however, Medicare's home health intermediaries continued to come under criticism for inconsistent interpretation of regulations (U.S. General Accounting Office 1986 and 1990). GAO

---

[3]In addition, alternative providers (such as nursing homes) may be unwilling to serve a particular type of patient (for example, ventilator-dependent patients or patients with dementia) if they do not perceive themselves as adequately compensated for caring for that type of patient or if they do not have the specialized resources the patient needs. Care for some of these patients may then fall to home health agencies, if the patients also have skilled needs.

noted that denial rates varied widely even among the 10 intermediaries, in part from differences in review practices (U.S. General Accounting Office 1990).

4. Differences in Agency and Physician Practice

Home health agency practice patterns, and those of the physicians who order home health services, may vary in response to regional differences in prevailing professional norms. These differences may result from a lack of consensus on the most effective means of treating a particular condition. Welch et al. (1993) concluded that a major contribution to cross-city variation in physician reimbursement was lack of consensus among physicians about which services were required. Physician discretion has also had a profound effect on variation in hospital admission rates (Wennberg et al. 1989; Wennberg et al. 1988; and Wennberg 1984). Regional variation in physician practice is also likely to play a role in the type and intensity of home health services physicians order or in whether physicians order home health at all. The use of practice guidelines and feedback from outcomes research to rationalize the delivery of medical care, especially inpatient hospital care, has only recently gained acceptance (Alter and Holzman 1992; Cordero and Christensen 1992; and Wennberg 1990). The development of practice guidelines for home health is in its infancy.

Intermediary behavior may also affect agency practice patterns. For example, a particular intermediary may require a great deal of documentation to support the medical necessity of ongoing home health care or very frequent visits, thus discouraging agencies from providing care over long periods or frequent visits over a short period. Resolution of the 1988 Duggan *v.* Bowen lawsuit led HCFA to clarify home health regulations in mid-1989. Although the reinterpreted regulations are now nearly five years old, there is anecdotal evidence that a substantial number of agencies have not attempted to make use of these clarifications because they still operate under the specter of the high denial rates of the mid-1980s.

Agency philosophy, which underlies agency practice patterns, also affects the amount or duration of care delivered. For example, agencies with a philosophy of teaching self-care focus on instructing

8

patients (or caregivers) to provide their own care, while other agencies tend to provide all needed care to patients, with less emphasis on instruction and eventual independence. Agency philosophy may also be affected by a "managed-care environment." Agencies in areas with a high HMO saturation exist in an environment that values cost and utilization control and may be likely to adopt such controls even for their cost-reimbursed business (informal telephone conversation with National Association for Home Care staff member 1994).

On the other hand, agencies that provide services to a substantial number of HMO enrollees may increase the provision of services to cost-reimbursed patients to compensate for lower reimbursement for HMO enrollees. Shaughnessy et al. (1994) compared home health use and costs for four groups of home health patients: (1) HMO enrollees receiving care from HMO-owned home health agencies; (2) HMO enrollees for whom the HMO had contracted with an outside home health agency; (3) fee-for-service patients receiving care from agencies that did little or no HMO business; and (4) fee-for-service patients receiving care from agencies that did a substantial amount of HMO business. They found that patients in the last group had the highest levels of home health use and costs.

D. OVERVIEW OF THE STUDY

This study has two objectives: (1) to investigate the sources of regional variation in Medicare home health use; and (2) to investigate the association between regional variation in use and patient outcomes potentially related to home health care. This report presents findings from a preliminary analysis of a nationally representative database composed of secondary data describing home health users and their characteristics, as well as the characteristics of agencies that served them and of the service environment in which the agencies operated. Although the study does not purport to provide a comprehensive or definitive explanation for regional variation in Medicare home health care, it does provide a starting point for investigating this variation.

II. THE STUDY DATABASE AND ANALYTIC APPROACH

The first step of this study was to build a nationally representative database of home health users, incorporating information from secondary data sources describing the users, the home health agencies that served them, and the service environments in which the agencies existed. In this chapter, we briefly describe the construction of the database and the analytic approach taken in the study.

A. THE STUDY DATABASE

The database for this study was based on a 25-percent random sample of beneficiaries identified (in late 1993) from those who had claims on Medicare's 1990, 1991, or 1992 40 Percent Home Health Bill Records files. (The 40 Percent files are based on a 40-percent random sample of beneficiaries selected using the terminal digit of beneficiary health insurance claim numbers.) The unit of observation for the study was a home health episode. A standard definition of episode was used to overcome agency differences in admission and discharge practices. Episodes of home health care were defined as periods covered by strings of consecutive Medicare claims for home health services that were preceded and followed by at least a 30-day hiatus in claims. The start date of an episode is the start date for the first claim in the string; the end date is the end date for the last claim in the string.[1]

The 40 Percent files provided data on all Medicare-covered home health services rendered between January 1990 and December 1992. For each home health episode record created, we included information on the number of visits rendered by discipline; total reimbursement; the state in which the agency was located (as per the first two digits of the agency's Medicare provider

---

[1]Agencies may code the end date for the last claim as the last day of the month, regardless of the actual date on which the last visit was rendered. A frequency of episode end dates suggested that this occurred for, at most, one-third of all study episodes, since roughly a third of all episodes ended on the 30th or 31st of the month. For these episodes, episode end dates may be later than the actual end of the episode, and episode length is somewhat overstated. However, we have no reason to believe that this overstatement differs by region.

number); the intermediary that processed claims for the episode; the primary and secondary diagnoses on the first claim; and the beneficiary's age, sex, and race. (Table II.1 summarizes all items in the database by source.) The state in which the agency is located was converted to geographic region according to the designation in Table II.2. (Geographic region was defined according to HCFA reporting conventions.)

Data from several sources were merged with the episode file. Data from Medicare Part A claims, describing service use and reimbursement over the six months prior to the episode, were added as proxies for severity of illness, acuity, and medical stability. Data describing service use during the 60 days following the episode were added as patient outcomes potentially related to home health care. Date of death from Medicare's Health Insurance Skeleton Write-Off (HISKEW) file was also used to construct a potential patient outcome measure. Medicare's Provider of Services (POS) files (as archived at the ends of 1990, 1991, and 1992) supplied descriptors of agency type and control, years in operation at episode start, and whether the agency had Medicaid certification. The 1993 Area Resource File (ARF) furnished information on the numbers of hospital beds, nursing home beds, and health care professionals for the county in which the agency was located, as well as urban/rural indicators and indicators of population wealth. We merged initial treatment plan data from Medicare's Regional Home Health Intermediary (RHHI) files with a subset of episodes that started in 1991.[2]

The resulting database, a 10-percent random sample of all Medicare home health users with episodes starting in 1990 through 1992, contains 634,844 episodes of home health care merged with

---

[2]In 1990, HCFA began to maintain data files containing information from the forms required of agencies for patient certification and care planning (HCFA 485/486 forms). These files were called the RHHI database. Each intermediary was to send information for the database to HCFA quarterly. Information transfer did not become fully operational until 1991. Subsequently, a number of intermediary and quarter-specific files were lost. When agencies were no longer required to routinely supply intermediaries with the 485/486 forms, the RHHI became defunct. At the time of this study, the RHHI seemed most complete for 1991. Thus, we attempted to merge only study episodes starting in 1991 with the RHHI. We were able to match over 70 percent of 1991 episodes identified from the 40 Percent files with RHHI data from the initial certification period for the episode.

TABLE II.1

DATA ITEMS CONSTRUCTED BY SECONDARY SOURCE

40 Percent Home Health Bill Records Files (1990-1992)	National Claims History Part A Records and HISKEW File (1989-1993)	Medicare Provider of Services Files (1990-1992)	Bureau of Health Professions Area Resource File (1993)	Medicare Regional Home Health Intermediary Files (1991)
Episode start and end dates	During 6 months prior to episode start:	Type of agency	Number of skilled Medicare nursing home beds per 1,000 beneficiaries	Functional limitations
Length of episode	Number of inpatient days	Type of control		Activities permitted
	Number of SNF days		Hospital occupancy rate	
Number of visits in episode, total and by discipline	Number of home health visits (all disciplines)	Whether agency Medicaid certified	Number of hospital beds per 1,000 persons 65 or older	Planned treatments for first certification period, by discipline
	Inpatient reimbursement			
Medicare reimbursement for episode	SNF reimbursement	Years Medicare certified at episode start	Average inpatient length of stay	
	Home health reimbursement			
State in which agency located	During the 14 days prior to episode start:		Proportions of hospitals with geriatric acute care, geriatric assessment, geriatric clinics, and home health agencies	
Intermediary used by agency	Whether had inpatient stay			
	Whether had SNF stay		Number of home health agencies per 10,000 beneficiaries	
Primary and secondary diagnoses at episode start	During 30 days following episode end:			
	Whether had inpatient stay		Number of physicians per 10,000 persons	
Beneficiary age, sex, race	Whether had inpatient stay for home health admitting diagnosis		Numbers of hospital-based registered and licensed practical nurses per 10,000 persons	
	Whether had SNF stay			
	Whether died		Numbers of hospital-based physical, occupational, and speech therapists per 10,000 persons	
	During days 31 to 60 following episode end:			
	Whether readmitted to home health		Per capita income	
	Whether readmitted to home health for same diagnosis		Proportion of elderly living in poverty	
			Average annual Medicare reimbursement	
			Urban/rural indicator	

HISKEW = Health Insurance Skeleton Write-Off; SNF = skilled nursing facility

TABLE II.2

ASSIGNMENT OF STATES TO GEOGRAPHIC REGIONS

New England
  Connecticut
  Maine
  Massachusetts
  New Hampshire
  Rhode Island
  Vermont

Middle Atlantic
  New Jersey
  New York
  Pennsylvania

East North Central
  Illinois
  Indiana
  Michigan
  Ohio
  Wisconsin

West North Central
  Iowa
  Kansas
  Minnesota
  Missouri
  Nebraska
  North Dakota
  South Dakota

South Atlantic
  Delaware
  District of Columbia
  Florida
  Georgia
  Maryland
  North Carolina
  South Carolina
  Virginia
  West Virginia

East South Central
  Alabama
  Kentucky
  Mississippi
  Tennessee

West South Central
  Arkansas
  Louisiana
  Oklahoma
  Texas

Mountain
  Arizona
  Colorado
  Idaho
  Montana
  Nevada
  New Mexico
  Utah
  Wyoming

Pacific
  Alaska
  California
  Hawaii
  Oregon
  Washington

NOTE: This assignment of states to regions coincides with that typically reported by HCFA.

data from Medicare claims, POS files, and the ARF; 156,798 of these episodes also contain RHHI data.[3] The 634,844 episodes included care for 459,382 beneficiaries.[4] (A number of different samples were used for analysis, as will be explained below. Table II.3 presents an overview of the primary samples used.)

This database is unique for two reasons: (1) it includes episode-specific data on patient, agency, and area characteristics together with measures of home health use and potential patient outcomes; and (2) unlike calendar-year databases of home health use, it contains episodes of care that continue for as long as three years.

B. ANALYTIC APPROACH

Our analysis begins with *tabulations by geographic region of home health use measures; patient outcomes; and patient, agency, and area characteristics*. The tabulations provide a relatively simple overview of major regional differences in home health use and potentially correlated characteristics. In particular, we compare tabulations of home health use and patient outcomes with those of patient, agency, and area characteristics to assess whether high- or low-use regions seem to have different patient outcomes, as well as different types of patients, agencies, service supply, or other area characteristics.

The tabulations are followed by *multivariate analysis of the relationship between home health use and geographic region, controlling for patient, area, and agency characteristics*. First, we address the question of whether controlling for these characteristics changes the effect of region on home health use or reduces the amount of variation in use observed. We compare regression-adjusted mean values of home health use measures by region as estimated from the following models:

---

[3]Of the 634,844 episodes, 29 percent started in 1990, 34 percent in 1991, and 37 percent in 1992.

[4]Seventy-four percent of the 459,382 beneficiaries had just one home health episode in the study database; 18 percent had two episodes; 5 percent had three episodes; and 3 percent had four or more episodes.

15

TABLE II.3

PRIMARY ANALYSIS SAMPLES

Sample	Analytic Component	Number of Episodes
Episodes that start in 1990, 1991, or 1992	Bivariate analysis of region and patient, agency, and area characteristics	634,844
Episodes that start in 1990 or 1991	Bivariate analysis of region and home health use	398,522
Episodes that start in 1990 or 1991 and that are complete by the end of 1992	Bivariate analysis of region and patient outcomes potentially related to home health	383,938
Episodes that start in 1991 and for which initial treatment plan data are available	Bivariate analysis of region and treatment plan data	156,798
Five percent random sample of episodes that start in 1990 or 1991	Multivariate analysis of home health use as a function of region and patient, agency, and area characteristics	19,764
Five percent random sample of episodes that start in 1990 or 1991 and that are complete by the end of 1992	Multivariate analysis of patient outcomes as a function of region and patient, agency, and area characteristics	19,037
Three subsamples of episodes for beneficiaries with diabetes, serious cardiopulmonary conditions, or stroke/serious neurological conditions	Multivariate analysis of home heath use conducted separately for each condition	Diabetes: 27,114 Serious Cardiopulmonary: 43,627 Stroke/Serious Neurological: 27,864

NOTE: Although mean home health use differs across these samples, regional patterns of home health use--the focus of this study--do not differ.

(1) $Y = b_1R + e$

(2) $Y = b_1R + b_2P + e$

(3) $Y = b_1R + b_2P + b_3E + e$

(4) $Y = b_1R + b_2P + b_3E + b_4A + e$,

where Y is a measure of home health use (episode length in days, number of visits in an episode, or number of visits per episode day), R is a vector of regional binaries (plus an indicator of the year in which the episode began), P is a vector of patient characteristics, E is a vector of environmental characteristics, A is a vector of agency characteristics, b_i are vectors of regression coefficients, and e is a random error term. (Table II.4 contains the characteristics used in the models.) Comparison of estimates from equations (2), (3), and (4) reflects the relative contributions to explained variance of patient, environmental, and agency characteristics, and which types of characteristics are most responsible for observed differences in use across regions.

The estimation techniques employed are dependent on the nature of the home health use measure. The models of visits per day are estimated with ordinary least squares regression. The models of episode length and number of visits are estimated with tobit because these measures are censored by the lack of data beyond the end of 1992. Our multivariate estimation was carried out only on the subsample episodes that started in 1990 or 1991 because those that started in 1992, particularly the second half of 1992, were so seriously censored that even tobit estimation would not compensate adequately.[5]

We also explore regional variation in home health use among subsamples of patients with the same general diagnosis at the start of their home health episodes to determine whether patients with the same conditions living in different regions receive the same duration and amount of care. By

---

[5]Because tobit uses a computationally intensive procedure to estimate coefficients, for all multivariate estimation we used a 5-percent random sample of beneficiaries who had the 398,522 episodes with 1990 or 1991 start dates. (The 5-percent sample contained 19,764 episodes, after some episodes that had missing data were eliminated.)

TABLE II.4

CONTROL VARIABLES FOR MULTIVARIATE ANALYSIS

Patient Characteristics
    Sex
    Race
    Age
    Principal condition (at episode start)
    Comorbid conditions (at episode start)
    Medicare service use and reimbursement (during the six months prior to episode)
        Inpatient
        SNF
        Home health
    Whether patient had inpatient stay ending during 14 days prior to episode
    Whether patient had SNF stay ending during 14 days prior to episode

Environmental Characteristics
    Urban/rural status
    Number of Medicare SNF beds per 1,000 beneficiaries
    Hospital occupancy rate
    Number of hospital beds per 1,000 persons 65 or older
    Average inpatient length of stay
    Proportions of hospitals with geriatric acute care, geriatric assessment, geriatric clinics, and
        home health agencies
    Number of home health agencies per 10,000 beneficiaries
    Number of physicians per 10,000 persons
    Numbers of hospital-based RNs and LPNs per 10,000 persons
    Numbers of hospital-based physical, occupational, and speech therapists per 10,000 persons
    Per capita income
    Proportion of elderly living in poverty
    Average annual Medicare reimbursement

Agency Characteristics
    Facility type
    Profit status
    Whether Medicaid certified
    Years in operation at episode start

Region of Agency and Year of Episode Start

restricting estimation to groups of patients with the same general condition, we may obtain more precise estimates of the relationship between home health use and control variables because the relationship may well be different for different patient conditions. For this part of the analysis, we selected three conditions that are seen frequently by Medicare home health agencies: (1) diabetes; (2) serious cardiopulmonary conditions; and (3) stroke or serious neurological conditions. This analysis begins to address the question of whether regional variation in home health use is driven by practice patterns for specific conditions.

We then present *a multivariate analysis of the relationship between patient outcomes and region, controlling for patient, area, or agency characteristics.* We compare regression-adjusted mean values of outcomes for each region, estimated from the following model:

$$(5) \quad Z = b_1 R + b_2 P + b_3 E + b_4 A + e,$$

where Z is a binary indicating a patient outcome (hospital admission within 30 days of episode end, skilled nursing facility (SNF) admission within 30 days of episode end, home health readmission between 31 and 60 days of home health end, or death within 30 days of episode end) and b_i, R, P, E, A, and e are as described above. We examine regression-adjusted means values of outcomes by region to determine whether, for example, regions with relatively lower home health use were more prone to what could have been adverse patient outcomes.

Patient outcome models are estimated with logit because all outcomes are binary measures. The sample will be restricted to episodes that started in 1990 or 1991 *and* that were completed by December 1992 to ensure that outcome measures truly reflect events that occurred after an episode of home health care.[6]

---

[6]As we discuss in Chapters III and IV, mean home health use differed for the various samples in our study, but the regional patterns of home health use--the focus of this study--were the same.

C. LIMITATIONS OF THIS STUDY

The lack of primary data limits the study results. The accessibility of secondary data, however, makes this type of database a reasonable starting point for investigating the sources of regional variation in Medicare home health use. Nevertheless, we recognize that many factors affecting home health use can only be measured with primary data, if at all (for example, patient compliance with prescribed treatments, and the availability and capability of informal caregivers). Data on factors related to service supply, such as home health agency capacity or the availability of home- and community-based services, would also have enhanced the database but were not readily available.[7,8]

Particularly because of its reliance on secondary data, our study must be viewed as highly tentative in its conclusions regarding patient outcomes (events that occur to patients following home health, identified with Medicare claims). First, while we can identify associations between regional variation in home health use, potential patient outcomes, and patient, agency, and area characteristics, we cannot determine the causality of outcomes. For example, if we observe that regions with lower than average home health use also have higher than average mortality, we may not be able to tell whether the higher mortality resulted from insufficient home health care or whether the higher mortality rate in the region caused fewer home health services to be used than in other regions. Second, it is not always possible to label an outcome as adverse. For example, hospital admission shortly after a home health episode could reflect an appropriate decision on the part of the agency to move a patient to a higher level of care, or it may reflect poor-quality home health care. Thus, in drawing conclusions about the relationship between home health use and patient outcomes, we

---

[7]HCFA's POS files contain the number of full-time-equivalent (FTE) staff employed by an agency. We did not include these data for three reasons: (1) the data were not available for 1990; (2) the data do not include staff contracted (rather than employed directly) by the agency; and (3) consultants on other studies have remarked that because agencies have difficulty computing FTEs, these data are often highly inaccurate.

[8]State-level data are available on Medicaid funding for home- and community-based service waiver programs. These data were not included in the study database primarily because the programs are often not statewide. Thus, state spending figures would not necessarily reflect the level of services available to a particular beneficiary.

must view all outcomes and all home health use measures as a whole. Even then, the conclusions must be taken as suggestive rather than definitive.

III. BIVARIATE RELATIONS BETWEEN REGION AND HOME HEALTH USE, PATIENT OUTCOMES, AND CHARACTERISTICS

We begin this chapter by describing tabulations of home health use measures by geographic region. The sample for these tabulations is composed of 398,522 episodes that started in 1990 or 1991. Episodes that started in 1992 are subject to a high degree of truncation as a result of building the database from home health claims data describing services rendered through 1992. Measures of home health use for episodes that started in 1992, therefore, would be greatly understated. To avoid this understatement, tabulations of home health use by region exclude episodes that started in 1992.[1]

We next describe tabulations of patient outcomes potentially related to home health. The sample for these tabulations are those episodes that started in 1990 or 1991 *and* that were completed by the end of 1992 (383,938 episodes). We restrict the sample to completed episodes to ensure that events described by outcome measures actually occurred after, and not during, home health episodes. This is a particular concern for inpatient or skilled nursing facility (SNF) stays of less than 30 days.

Finally, we present a summary of many tabulations of patient, agency, and area characteristics and treatment plan data by region to identify associations between regional patterns of home health use and particular characteristics. The sample for the tabulations of characteristics is the 634,844 episodes starting in 1990, 1991, or 1992. (The sample for tabulations of treatment plan data is the 156,798 episodes that could be merged with data from the RHHI files.) We included all episodes in these tabulations to make maximum use of the sample. Since the characteristics and treatment plan data were measured at episode start, they are not affected by truncation.

Although mean home health use differs for the four samples just described, regional patterns of home health use do not differ. (See Appendix A, Table A.1, for a comparison of mean home health

---

[1]Among the 398,522 episodes that started in 1990 or 1991, just under 4 percent were ongoing in December 1992 (compared with 30 percent of episodes that started in 1992). Thus, even the tabulations presented here somewhat understate home health use.

use measures by region for the four samples analyzed in this chapter. See Table II.3 for an overview of all the samples used in the study.)

A. HOME HEALTH USE

A mean of 47 visits were rendered during a typical Medicare home health episode that started in 1990 or 1991. (See Table III.1.) Consistent with earlier findings, many fewer visits were rendered, on average, by agencies in the Pacific and Middle Atlantic states (28 and 30 visits per episode, respectively), while many more were rendered by agencies in East South Central and West South Central states (95 and 64 visits, respectively). This range in visits rendered gives rise to more than a 200-percent difference between the highest- and lowest-use regions.

Both the length of an episode and the number of visits rendered per day contribute to the number of visits rendered during an episode. Each could potentially account for part of the large regional variation we observed in visits rendered per episode. However, there is not a great deal of variation across regions in visits rendered per day.[2] Nationally, .52 visits were rendered per episode day, or just over seven visits every two weeks. The smallest number of visits per day was rendered for episodes in the East and West North Central states (.44 and .46, respectively, or roughly six visits every two weeks), while the highest was rendered for episodes in the South Atlantic states (.61, just over eight visits every two weeks), resulting in just under a 40 percent difference between the highest- and lowest-use regions.

By contrast, enormous variation occurred across regions in mean episode length. Episodes averaged 94 days nationally. However, we observed episodes that averaged 180 days in the East South Central states, but episodes that averaged only 60 days in the Pacific states--a difference of 200

---

[2]The number of visits per day was computed by dividing the number of visits rendered during an episode by the number of days in the episode.

TABLE III.1

VISITS RENDERED AND EPISODE LENGTH BY GEOGRAPHIC REGION

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Number of Visits per Episode										
Mean	55.8	30.4	36.1	33.6	51.7	94.6	64.2	42.6	27.5	**46.5**
Median	15	14	14	14	22	27	20	15	12	**16**
Mean Number of Visits per Episode Day	.57	.50	.44	.46	.61	.51	.54	.57	.50	**.52**
Episode Length (Days)										
Mean	95.3	66.3	93.9	83.4	94.2	180.3	121.3	77.1	59.7	**94.1**
Median	42	38	46	40	46	66	54	37	31	**43**
Episode Length (Percent Distribution)										
1 to 30 days	38.3	41.1	34.7	40.0	34.2	24.7	31.2	42.9	49.5	**37.2**
31 to 60 days	26.4	33.0	30.0	28.9	31.4	21.1	26.4	27.5	28.4	**29.1**
61 to 90 days	10.5	9.6	10.2	9.1	10.1	10.3	10.3	9.6	7.9	**9.7**
91 to 180 days	12.3	9.6	12.6	11.3	11.9	15.0	13.0	10.1	8.0	**11.3**
181 to 365 days	5.8	3.8	6.3	5.6	6.1	10.7	9.2	5.4	3.4	**6.0**
More than 365 days	6.7	2.9	6.2	5.1	6.2	18.1	9.9	4.4	2.7	**6.5**
Number of Episodes	27,798	67,409	60,355	24,244	80,636	34,850	38,556	14,943	49,731	**398,522**

SOURCE: Medicare 40 Percent Home Health Bill Records files, 1990-1992.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing. This table is based on episodes starting in 1990 or 1991 to avoid the extreme censoring of episodes starting in 1992. Episodes with end dates in December 1992 may have continued into 1993; there were 4,674 such episodes among those starting in 1990 (2.5 percent) and 9,910 among those starting in 1991 (4.6 percent).

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

percent. Episodes were also much longer than average in the West South Central states (121 days) and much shorter in the Middle Atlantic states (66 days).[3]

Estimates of mean episode length will be very sensitive to the presence of unusually long episodes. The database for this study contains episodes that start as early as 1990 and that could continue through 1992. Thus, study episodes could be up to three years long. In fact, much higher percentages of episodes longer than 180 days occurred in the East and West South Central regions (the regions with the longest mean episode lengths). Twenty-nine and 19 percent of episodes in these regions, respectively, were longer than 180 days, and median episode length was 66 and 54 days, respectively. By contrast, only 6 percent of episodes in the Pacific region and 7 percent of episodes in the Middle Atlantic region were longer than 180 days. Median episode length in the Pacific and Middle Atlantic regions was 31 and 38 days, respectively. Concomitantly, the Pacific region had a much higher than average percentage of episodes lasting 30 days or less (slightly under 50 percent), while the East South Central region had a much lower percentage of very short episodes (25 percent).

Types of Visits. Ninety-two percent of all episodes starting in 1990 or 1991 included at least one skilled nursing visit; 64 percent of all visits rendered during an episode were skilled nursing visits.[4] (See Table III.2.) We do not observe much regional variation in inclusion of a skilled nursing visit in a typical episode. The proportion of visits for skilled nursing ranges from 60 to 70 percent, with the highest proportions in the North Central regions.

Forty-two percent of all episodes included one or more visits from a home health aide; aide visits made up 20 percent of all episode visits. The amount of home health aide visits varied somewhat

---

[3]The robustness of this pattern of home health use is reflected in Table A.1 (Appendix A). The South Central regions always have markedly higher per episode use, while the Middle Atlantic and Pacific regions always have markedly lower per episode use, regardless of the sample.

[4]Medicare home health episodes must include visits from either a skilled nurse or physical therapist.

TABLE III.2

TYPE OF HOME HEALTH VISITS RENDERED BY GEOGRAPHIC REGION

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Any Visit (Percentage)										
Skilled Nurse	90.1	93.6	94.5	93.2	90.3	94.4	93.7	91.4	87.6	**92.0**
Home Health Aide	43.1	35.8	36.3	39.3	47.9	51.5	46.1	44.7	37.0	**41.9**
Therapist	35.2	35.7	29.2	25.6	35.6	26.7	25.8	40.9	46.2	**33.8**
Medical Social Visits	8.4	12.5	12.9	10.2	18.1	12.6	12.0	20.5	32.3	**16.0**
Percentage of Visits										
Skilled Nurse	61.9	67.0	69.5	68.7	59.8	59.9	63.9	59.8	59.2	**63.5**
Home Health Aide	21.3	16.2	16.1	17.9	22.6	29.2	23.9	19.6	14.3	**19.7**
Therapist	15.9	15.8	13.2	12.6	16.3	10.1	11.4	18.7	23.0	**15.4**
Medical Social Worker	0.6	0.9	1.1	0.8	1.1	0.6	0.7	1.7	3.4	**1.2**
Mean Episode Length (Days)	95	66	94	83	94	180	121	77	60	**94**
Mean Number of Visits per Episode	56	30	36	34	52	95	64	43	28	**47**
Number of Episodes	27,798	67,409	60,355	24,244	80,636	34,850	38,556	14,943	49,731	**398,522**

SOURCE: Medicare 40 Percent Home Health Bill Records files, 1990-1992.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing. This table is based on episodes starting in 1990 or 1991 to avoid the extreme censoring of episodes starting in 1992. Episodes with end dates in December 1992 may have continued into 1993; there were 4,674 such episodes among those starting in 1990 (2.5 percent) and 9,910 among those starting in 1991 (4.6 percent).

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

more than that of skilled nursing visits. In the East South Central states, where episodes were longest, 52 percent of episodes had one or more aide visits, and aide visits accounted for 29 percent of all visits. By contrast, among Pacific states, where episodes were shortest, only 37 percent of episodes included an aide visit, and aide visits accounted for only 14 percent of all visits.

Thirty-four percent of all episodes included at least one visit from some type of therapist (usually a physical therapist); therapy visits made up 15 percent of all visits. We observe great variation in the inclusion of a therapy visit in episodes. Episodes in the Pacific and Mountain regions were much more likely to include a therapy visit (46 and 41 percent, respectively). Moreover, therapy visits made up 23 percent of all visits among episodes in the Pacific states. On the other hand, episodes in the East and West South Central regions were much less likely to include such visits (27 and 26 percent, respectively), and only 10 to 11 percent of visits were for therapy.

Sixteen percent of episodes included at least one visit from a medical social worker; such visits made up just 1 percent of all visits. The inclusion of at least one social work visit ranged from 8 percent in New England to 32 percent in Pacific states. Moreover, in the Pacific states medical social work made up 3 percent of visits.

B. PATIENT OUTCOMES

Regional variation in measures of patient outcomes potentially related to home health care was generally more modest than that observed for home health episode length, visits rendered, and skill mix. This suggests, albeit tentatively, that the observed extremes of home health use do not lead to either better or worse outcomes for patients.

Twenty-two percent of all completed episodes (starting in 1990 or 1991) ended with, or were followed within 30 days by, a hospital admission.[5] Just under one-quarter of these episodes were for

---

[5]Measures of inpatient and SNF admission after home health are somewhat crude because the episode end date is sometimes the end date of a billing period rather than the day of the last home health visit. To compensate when constructing these outcome measures, if claims data showed a beneficiary to have had a inpatient (or SNF) admission that started prior to the end of the home
(continued...)

the same general diagnosis as the home health episode. (See Table III.3.) A slightly higher percentage of episodes in the East South Central region (26 percent) were followed by a hospital stay.

Eleven percent of completed episodes were followed by a home health readmission within 31 to 60 days of the original admission.[6] Roughly one-half of readmissions were for the same general diagnosis as the original episode. Rates of readmission were noticeably higher among the East and West South Central states (19 and 14 percent, respectively), the regions with the highest use during original episodes. Conversely, rates of readmission were lowest for patients in the Pacific and Middle Atlantic regions (8 and 9 percent, respectively), which had the lowest use during original episodes. This pattern suggests that agencies were not discharging patients prematurely and then readmitting them in the Pacific and Middle Atlantic regions.

Four percent of completed episodes were followed within 30 days by a Medicare SNF admission. Episodes in the North Central, Mountain, and Pacific regions were somewhat more likely to be followed by a SNF admission than were episodes in other regions.

Overall, 12 percent of beneficiaries died within 30 days of the end of home health episodes (including those whose episodes were terminated at death). Sixteen percent of beneficiaries died within the 30 days following episodes in the East South Central states; 11 percent died following episodes in the Middle Atlantic states.

Summary. Patterns of home health use and patient outcomes suggest that patients of agencies in the South Central states may be using home health as a type of long-term care, with above-average

---

[5](...continued)
health episode but that ended after the end of the episode, we counted such an admission as occurring within 30 days of episode end.

[6]Because home health episodes for this study were defined by periods covered by strings of home health claims preceded and followed by 30-day gaps in claims, we can only detect a home health readmission following a 30-day hiatus in the preceding home health episode.

TABLE III.3

PATIENT OUTCOMES BY GEOGRAPHIC REGION

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Inpatient Admission Within 30 Days of Episode End (Percentage)	23.2	22.8	23.9	22.2	20.9	26.0	23.8	20.6	19.6	22.4
Inpatient Admission Within 30 Days for Same Diagnostic Group as Home Health (Percentage)	5.5	5.4	5.4	5.3	4.4	4.6	4.9	4.7	4.6	5.0
Home Health Readmission Between 31 and 60 Days After Episode End (Percentage)	13.3	8.9	10.4	8.8	10.8	19.3	13.5	9.1	8.4	11.0
Home Health Readmission Between 31 and 60 Days for Same Diagnostic Group as Original Episode (Percentage)	8.3	4.3	6.2	5.2	5.7	12.2	8.1	4.8	4.2	6.2
SNF Admission Within 30 Days of Episode End (Percentage)	3.5	2.9	5.2	6.5	3.3	4.7	4.4	6.6	5.3	4.3
Died Within 30 Days of Episode End (Percentage)[a]	11.6	10.7	13.2	11.4	12.3	16.3	13.6	11.9	11.6	12.4
Mean Episode Length (Days)[b]	73	58	75	68	74	117	96	64	52	73
Mean Number of Visits per Episode[b]	41	27	29	28	41	58	49	35	24	36
Number of Episodes	26,684	66,360	58,298	23,570	77,748	30,890	36,697	14,588	49,103	383,938

SOURCE: Medicare National Claims History, Standard Analytical Files, 1990-1993.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing. This table is based on episodes starting in 1990 or 1991 and completed prior to December 1992 to ensure that patient outcomes occurred following, rather than during, the home health episode. However, regional patterns of episode length and visits rendered are the same for the sample of all episodes starting in 1990 or 1991 as they are for the sample of completed episodes starting in 1990 or 1991.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

[a] Death dates were inconsistent with service use data for 28 episodes and were omitted from this tabulation.

[b] Means of episode length and number of visits per episode are based on the episodes starting in 1990 or 1991 and completed prior to December 1992.

30

use of home health aide services and below-average use of therapy. Patients in these regions also are more likely to have home health readmissions, underscoring the ongoing nature of their care. Patients in the East South Central region are somewhat more likely to enter the hospital or die soon after home health, which suggests that they are also more frail than home health patients elsewhere. Because they are receiving *more* home health care--not less--than patients in other regions, however, we can rule out the implication that a lack of access to home health care is leading to their higher rates of hospitalization and mortality.

By contrast, patients of agencies in the Pacific region (and, to a lesser extent, the Middle Atlantic region) seem to be using home health as relatively shorter-term, rehabilitative care. Patients in Pacific states receive notably more therapy and medical social services. Patients of home health agencies in the Pacific region are also less likely to enter the hospital following home health, and patients of agencies in the Pacific and Middle Atlantic regions are slightly less likely to be readmitted to home health or to die soon after study home health episodes. These claims-based outcome data suggest that lower home health use is not associated with poorer patient outcomes.

C. PATIENT, AGENCY, AND AREA CHARACTERISTICS

We examined the relationships between geographic region and several dozen patient, agency, and area characteristics. A heuristic summary follows in which we focus primarily on the four geographic regions with extremes of home health use: (1) East South Central; (2) West South Central; (3) Middle Atlantic; and (4) Pacific. (See Table III.4.) Tabulations of the characteristics by region used in the summary table appear in Appendix A, Tables A.2 through A.12.

Patient Characteristics. There was relatively little regional variation in the demographic characteristics of patients at the start of home health episodes that began in 1990, 1991, or 1992. (See Table A.2.) One notable exception was that the proportion of nonwhite patients was higher than average in the South Central regions, but lower than average in New England and the Mountain region. While these differences largely reflect racial differences in the general population, Helbing

TABLE III.4

SUMMARY OF RELATIONSHIPS BETWEEN REGION AND PATIENT, AGENCY, AND AREA CHARACTERISTICS

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
Patient Characteristics	- nonwhite					+ nonwhite	+ nonwhite	- nonwhite	
	- incont - malnu	-incont - malnu	+ CHF		- CHF	+ diabetes + hyper/ CVC + incont + malnu - cancer	+ diabetes + hyper/ CVC	+ respira + COPD - hyper/ CVC	- diabetes - hyper/ CVC
		+ post-acute + prior IP days		+ post-SNF - prior home health		+ prior home health - postacute -post-SNF	+ prior home health - postacute	+ post-SNF - prior IP days	+ post SNF - prior IP days
Agency Characteristics	+ VNA + nonprofit + years	+ VNA + nonprofit + years		+ hosp-based + gov't	+ free-st + profit	+ free-st + profit + gov't - years	+ free-st + profit - years	+ hosp-based	+ hosp-based
Characteristics of County Where Agency Located	+ metro + MDs - LPNs + hosp occ + income - elder pov	+ metro + MDs, RNs + hosp occ - HHAs + Medicare $		- metro	- HHAs	- metro + RNs, LPNs + HHAs - income + elder pov	- MDs + LPNs - hosp occ + HHAs - income + elder pov	- Medicare $	+ metro - RNs, LPNs - HHAs - elder pov
Mean Episode Length (Days)[a]	95	66	94	83	94	180	121	77	60
Mean Number of Visits per Episode[a]	56	30	36	34	52	95	64	43	28
Number of Episodes	44,427	106,349	95,778	38,778	130,100	52,830	64,395	24,520	77,667

TABLE III.4 *(continued)*

KEY:
cancer = serious cancer (principal diagnosis)
CHF = congestive heart failure (secondary diagnosis)
COPD = chronic obstructive pulmonary disease (secondary diagnosis)
diabetes = diabetes (principal diagnosis)
elder pov = proportion of elderly living in poverty
free-st = freestanding agencies
hosp occ = hospital occupancy rate
hyper/ CVC = hypertension or cerebrovascular condition (principal diagnosis)
incont = incontinence (secondary diagnosis)
IP = inpatient hospital
malnu = malnutrition, dehydration, or electrolyte imbalance (secondary diagnosis)
Medicare $ = average annual Medicare expenditures
metro = metropolitan areas
postacute = had an inpatient stay during the 14 days prior to episode start
post-SNF = had an SNF stay during the 14 days prior to episode start
respira = acute or serious respiratory condition (principal diagnosis)
years = number of years Medicare certified

et al. (1993) found that nonwhite beneficiaries were more likely to use home health services and received more visits per user than did white beneficiaries.

Patients in the South Central regions were more likely than average to have primary diagnoses at the start of study episodes of diabetes or hypertension and other cerebrovascular conditions, while patients in the Pacific region were less likely to have these conditions. (See Table A.3.) Phillips et al. (1992) found diabetes to be associated with increased home health use over the first 120 days of an episode; even greater resources were consumed caring for patients who required a nurse to administer insulin.

Patients in the East South Central region were also much more likely to have a secondary diagnosis of incontinence, while those in the Middle Atlantic region and New England were somewhat less likely to have that diagnosis. (See Table A.4.) In addition to the immediate problems of incontinence, incontinent patients are more likely to develop decubitus ulcers of the trunk that are difficult to heal and, if catheterized, are more likely to develop frequent urinary-tract infections, all of which may extend the need for home health care. Patients in the East South Central region were also somewhat more likely than average to have a secondary diagnosis of malnutrition or dehydration, an indicator of poor health status.

Patients in the South Central regions had many more home health visits during the six months prior to the study episode and were much less likely to have had a hospital stay ending during the two weeks before home health. (See Table A.5.) In contrast, patients of agencies in the Middle Atlantic region were more likely to have had a hospital stay during the two weeks prior to home health and, thus, were using home health as postacute care. Middle Atlantic patients also had a greater than average number of days in the hospital over the six months prior to home health. If the number of days spent in the hospital were a proxy for acuity, home health patients in the Middle Atlantic region could be viewed as more acutely ill at the start of home health episodes than patients

34

elsewhere. However, the high number of prior hospital days may also reflect physician practice patterns in that region.

Patients of agencies in the Pacific, West North Central, and Mountain states were more likely to have had a SNF stay just prior to starting their home health episodes. Episodes in these regions were also more likely to be followed by a SNF stay. We conjecture that SNFs may play a more important role in the continuum of care for Medicare beneficiaries in these regions.

The higher incidence of chronic conditions such as diabetes, hypertension, and other cerebrovascular conditions and the increased use of home health during the six months prior to the study episode strongly support the notion that many patients in the South Central regions--where home health use is highest--are using home health as a type of long-term care. Patients of agencies in the Middle Atlantic region--where home health use is relatively low--seem to be more likely to use home health as short-term, postacute care.

Agency Characteristics. Agency type varied widely across regions. (See Table A.6.) Visiting Nurse Associations (VNAs) provided a much higher proportion of the episodes in New England and the Middle Atlantic states than elsewhere, while hospital-based agencies provided a higher proportion of the episodes in the West North Central, Mountain, and Pacific regions. Non-VNA freestanding agencies were the most common agency type in the South Atlantic and South Central regions. Helbing et al. (1993) found that non-VNA freestanding agencies provided substantially more visits per user (45 visits, compared with 36 overall).

Agency control also varied widely across regions. Nonprofit agencies provided care for most episodes in New England and the Middle Atlantic. This is due in part to VNAs' nonprofit status. However, proprietary agencies provided care for the majority of episodes in the South Central and South Atlantic regions. The agency control distribution for the Pacific region was nearly identical to the national distribution--most episodes were provided by nonprofit agencies.

Area Characteristics. Most episodes were delivered by agencies located in metropolitan counties. (See Table A.9.) This was more likely to be true for the New England, Middle Atlantic, and Pacific regions. By contrast, in the West North Central and East South Central regions a higher proportion of episodes were delivered by agencies in nonmetropolitan counties. Kenney (1993) noted that home health agencies in urban areas provide a broader range of services than those in rural areas.

The Middle Atlantic region had the highest concentrations of physicians and registered nurses (RNs) per 10,000 residents, while the East South Central region had relatively high concentrations of RNs and licensed practical nurses (LPNs).[7,8] (See Table A.10.) The West South Central region had the lowest concentration of physicians, but a relatively high concentration of LPNs. The Pacific region had the lowest concentration of RNs and LPNs. Home health agencies in areas with a short supply of nurses may have to reduce the amount of care they supply.

If hospitals have low occupancy rates, they may keep patients longer and discharge them to home health with fewer care needs. On the other hand, low occupancy rates might result from the pressures of managed care or prospective payment. If so, the rates may be associated with shorter hospital stays and patients with greater posthospital needs. However, the Middle Atlantic states had the highest occupancy rates, while the Pacific states had somewhat below average rates, and yet both regions had relatively low home health use. (See Table A.11.)

---

[7]Not all agencies employ LPNs. When they do employ LPNs, they work under the supervision of RNs and are not usually responsible for care plan development.

[8]Data on the supply of nurses and therapists presented in Table A.10 (Appendix A) are for hospital-based personnel. No recent data were available on the supply of *nonhospital-based* nurses and therapists. Levels of hospital-based professionals might be positively correlated with those of similar professionals working in home health. On the other hand, if hospitals were appreciably more (or less) desirable places to work than home health agencies, the supply of hospital-based professionals might be negatively correlated with the supply of similar professionals working in home health. In addition, if hospitals employed relatively more therapists and provided more therapy services, there might be less demand for therapy services from home health agencies.

Although the supply of home health agencies per se does not reflect the capacity of the agencies to provide care, it may reflect the extent to which beneficiaries have a choice of agencies when the need for home health arises or the competitiveness of the local home health market. (See Table A.11.) There were relatively more agencies per beneficiary in the South Central states and relatively fewer per beneficiary in the Middle Atlantic and Pacific states. (However, this is due in part to the South Central states being more rural and less populated, while the Middle Atlantic and Pacific states are more urban and more populated.)

Finally, per capita income in counties in which home health agencies provided care during study episodes was highest in New England (and the Middle Atlantic region) and lowest in the South Central regions. (See Table A.12.) The proportion of elderly persons living in poverty was also highest in the South Central regions, but was lowest in the Pacific region. Low income is often associated with poor health and may increase the use of home health care. Mean annual Medicare spending (which partially reflects health status and partially reflects medical practice patterns) was highest in the Middle Atlantic states and lowest in the Mountain states.

Summary. Home health care in the South Central regions appears to be dominated by free-standing, proprietary agencies and is more likely to be provided in nonmetropolitan areas and areas in which residents, particularly elderly residents, have relatively low incomes. By contrast, care in the Middle Atlantic region is dominated by nonprofit VNAs, while care in the Pacific region is frequently provided by hospital-based agencies. Care in both the Middle Atlantic and Pacific regions is more likely to be provided in metropolitan areas and areas in which elderly residents have relatively high incomes.

D. TREATMENT PLAN DATA

We examined data from HCFA 485/486 forms associated with the first treatment plan for each episode, as available on the RHHI files.[9] Below we summarize tabulations of treatment plan data by region that appear in Appendix A, Tables A.13 through A.17, focusing on treatment plan patterns among the South Central, Middle Atlantic, and Pacific regions. (See Table III.5.)

Functional Limitations and Permitted Activities. There was only limited regional variation in the reporting of functional limitations. (See Table A.13.) The notable exceptions were for reporting bowel or bladder incontinence and dyspnea (shortness of breath) with minimal exertion. Incontinence was most likely to be reported by agencies in the South Central regions (consistent with its more frequent appearance as a secondary diagnosis), but was least likely to be reported by agencies in New England and the Middle Atlantic. Dyspnea was most likely to be reported in the East South Central region (as was hearing limitation), but was least likely to be reported in the West South Central region. As noted above, incontinence has been associated with above-average home health use. Severe dyspnea is an indicator of poor health and could interfere with a patient's ability to carry out treatment regimens or personal care, which in turn could lead to greater use of home health services.

Permitted activities include both physicians' orders for activity restriction and use of equipment to assist with ambulation. We observed substantial regional variation in orders for activity restriction, particularly among the most common orders (up as tolerated, transfer from bed to chair, and bed rest with bathroom privileges). (See Table A.13.) The variation, however, is almost certainly due to agency and physician practice rather than patient differences, because the orders themselves seem to reflect roughly the same level of activity restriction for the patient. While there is little regional variation in the use of ambulation equipment, the West South Central region has a markedly higher

---

[9]Among the episodes with RHHI data, those from the Pacific states (with their lower than average home health use) are somewhat underrepresented. Otherwise, the full study sample and the subsample with RHHI data are generally similar.

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
Functional Limitations and Activities Permitted	- incontinence	- incontinence				+ incontinence + dyspnea + hearing	+ incontinence - dyspnea		
	+ up as tol - transfer	+ up as tol	+ transfer	+ up as tol - transfer			- up as tol + bed rest BRP		
							- walker + wheelchair + crutches		
Skilled Nursing Treatments	- venipunct	- venipunct	+ restor rn	- restor rn - plan mgt		+ venipunct - restor rn - plan mgt	+ venipunct + plan mgt		- venipunct
Therapy Treatments				- all		- all	- all	+ all	+ all
Medical Social Services	- all								+ all
Home Health Aide Services	+ meal prep	- tub bath + housekeep + meal prep	- housekeep - meal prep	- bed bath - ambula - meal prep		+ bed bath - meal prep	+ tub bath + housekeep	- bed bath + tub bath	- ambula - meal prep
Mean Episode Length (Days)	92	66	90	82	93	164	120	83	69
Mean Number of Visits per Episode	60	33	37	34	54	86	65	49	34
Number of Episodes	12,046	29,290	28,643	12,182	27,585	11,503	18,933	5,808	10,808

SOURCE: Medicare Regional Home Health Intermediary Database, 1991.

39

TABLE III.5 *(continued)*

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

This table provides a heuristic summary of the tabulations of characteristics by region presented in Appendix A, Tables A.13 through A.17. The "+" indicates that the mean for the region was in the neighborhood of 20 to 40 percent above the national mean; the "-" indicates that the mean for the region was in the neighborhood of 20 to 40 percent below the national mean. However, the distribution of the characteristic across regions also affected the designation of "+" or "-". For example, if there was little variation across most regions, but the mean for one region was noticeably different, but less than 20 percent above or below the national mean, it will appear in this table.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

KEY:
  ambula = assistance with ambulation
  bed rest BRP = bed rest with bathroom privileges
  housekeep = housekeeping
  incontinence = bowel or bladder incontinence
  meal prep = meal preparation
  plan mgt = management and evaluation of a care plan
  restor rn = restorative nursing
  transfer = transfer from bed to chair
  up as tol = up as tolerated
  venipunct = venipuncture

40

incidence of the use of crutches and wheelchairs and a much lower use of walkers than any of the other regions. It is difficult to understand from our data why this should be so.

Skilled Nursing Treatments. There was little regional variation in the inclusion in treatment plans of the most commonly used nursing treatments. (See Table A.14.) Venipuncture was a notable exception. It was much more likely to appear in treatment plans in the South Central regions and much less likely to appear in plans in New England and the Middle Atlantic and Pacific regions. Venipuncture is required for patients on blood thinners or certain heart medications and for some patients on insulin. Moreover, patients who require venipuncture in the home (those who cannot go to a physician's office or laboratory for blood drawing or who do not have informal caregivers to take them out of the house for blood drawing) represent a highly debilitated group with multiple skilled care needs or a group whose caregiving system is very limited or fragile (Schore and Phillips 1992).[10] The much higher incidence of venipuncture in treatment plans in the South Central regions is consistent with the emerging picture of home health patients in these areas as more likely to be chronically ill and frail, and, therefore, requiring long-term home health care.

Care plan management and evaluation, which allows nurses to monitor care provided by informal caregivers and home health aides for certain complex cases, has the potential to substantially extend a home health episode. However, its inclusion in treatment plans in the East South Central region (the region with the longest episodes) was well below average, although its inclusion was well above average in the West South Central region (the region with the next longest episodes).[11]

---

[10]This reference summarizes the viewpoints of a clinical panel of home health professionals convened to discuss the determinants of home health treatments associated with high-cost episodes.

[11]In an examination of the use of care plan management and evaluation during 1991 by agencies using four of the nine fiscal intermediaries, Stone et al. (1993) found that the treatment tended to be prescribed for patients who were also prescribed a range of services from home health aides. Thus, it was likely that care plan management was being used to monitor aide services for these patients. Our data show that two of the areas in which episodes had relatively high proportions of aide visits (West South Central and New England) also had higher than average use of care plan management, while two other areas with high aide use (East South Central and South Atlantic) had lower than average use of care plan management.

Therapy Treatments and Medical Social Services. Regional variation in the inclusion of therapy and medical social services in treatment plans was consistent with the variation observed in the provision of those services. (See Table III.2 and Appendix Tables A.15 and A.16.) Treatment plans from agencies in the Pacific and Mountain states were much more likely to include each of the most common therapy treatments, while treatment plans from agencies in the South Central and West North Central regions were generally much less likely to include them. Similarly, treatment plans from agencies in the Pacific region were much more likely to include each of the medical social services, while plans from agencies in New England were much less likely to include them.

Home Health Aide Services. The regions with the highest home health use (East and West South Central) were more likely to include visits from home health aides and included more visits than average, whereas the regions with the lowest use (Middle Atlantic and Pacific) were less likely to include aide visits and included fewer than average. (See Table III.2 and Appendix Table A.17.) Although regional variation exists in the types of aide services included in treatment plans, the variation shows no clear regional pattern.

E. CONCLUSION

Consistent with earlier studies, we find home health use to be higher in the East and West South Central regions and lower in the Middle Atlantic and Pacific regions. Differences in visits rendered per episode across these regions are driven largely by differences in episode length. Home health users in the South Central regions emerge as patients with long-term needs. Their study episodes were much longer than average, and they had greater numbers of home health visits during the six months prior to study episodes. They also were more likely to have new episodes within 31 to 60 days following study episodes.

Patients in both South Central regions were much more likely to have a principal diagnosis of diabetes or hypertension or other cerebrovascular condition; patients in the East South Central region (which had the higher home health use of the two regions) were also more likely to be incontinent

or to suffer from malnutrition or dyspnea. Patients in both regions were more likely to have venipuncture in their initial treatment plans. Thus, these patients emerge as more chronically ill and frail, which is underscored by their somewhat higher than average use of home health aide services and their higher rates of mortality and hospital admission following home health.

A very different profile emerges of home health patients in the Middle Atlantic and Pacific regions. Patients in the Middle Atlantic region are more likely to enter home health within two weeks of a hospitalization (using home health as postacute care); they also have spent an above-average number of days in the hospital during the six months prior to home health. Patients of agencies in the Middle Atlantic and Pacific regions tend to be less likely to have diabetes or incontinence and are much less likely to have venipuncture in their treatment plans. Patients in the Pacific region receive a great deal more rehabilitative care and medical social services than patients elsewhere. Thus, patients in these regions emerge as less frail and chronically ill than their counterparts in the South Central regions.

Patients in the South Central regions are more likely to be served by home health agencies located in nonmetropolitan areas and in areas with above-average levels of poverty, particularly among the elderly. The agencies that serve them are largely freestanding and proprietary. Patients in the Middle Atlantic and Pacific regions are more likely to be served by agencies located in metropolitan areas and in which elderly residents have relatively higher incomes. The agencies that serve them tend to be nonprofit. In the Middle Atlantic region, most agencies are VNAs, while in the Pacific region, most are hospital based.

IV. MULTIVARIATE RELATIONS BETWEEN REGION AND HOME HEALTH USE, PATIENT OUTCOMES, AND CHARACTERISTICS

In Chapter III, we discussed the substantial regional variation observed in Medicare home health use and marked variation in certain patient, agency, and area characteristics, but relatively less variation in potential patient outcomes. We now turn to multivariate analysis to assess the joint effect of patient, area, and agency characteristics on regional variation in home health use and potential outcomes.

In the sections below, we address the following questions:

- Does controlling for patient, area, and agency characteristics change the observed differences in home health use across geographic regions? That is, after holding these characteristics at the national means, is the regional variation reduced or do different regions emerge as having above- or below-average use?

- Does controlling for patient, area, and agency characteristics change the relative lack of regional variation observed in patient outcomes potentially related to home health care?

As discussed in Chapter II, we use iterative statistical procedures--tobit and logit analysis (as well as ordinary least squares regression) to estimate the multivariate models employed to address these questions. Because iterative estimation makes it impractical to use samples containing hundreds of thousands of episodes (which we did in our bivariate analysis), we randomly selected 5 percent of available episodes for these analyses (yielding samples of just under 20,000 episodes).[1]

Our bivariate analysis showed that, in some regions (for example, the East South Central region), a small but substantial number of home health episodes continued beyond a year. The incidence of these very long episodes "explained" some of the dramatic regional variation observed in visits rendered per episode. Thus, we conclude this chapter with a cross-region comparison of the patient,

---

[1] Although mean home health use and patient outcomes differed across the samples used for our analyses, regional patterns of home health use and extremes of patient outcomes did not generally differ. (See Appendix B, Tables B.1 and B.11, which compare means of use and outcome measures, respectively, for the 5-percent and full samples.)

area, and agency characteristics associated with episodes longer than a year. Because models for this analysis are estimated separately for each region, we used the full sample of episodes starting in 1990 or 1991, rather than the 5-percent sample.

A. POTENTIAL DETERMINANTS OF REGIONAL VARIATION IN HOME HEALTH USE

We estimated multivariate models to determine the effect of patient, area, and agency characteristics on the regional variation of home health use. As described in Chapter II, we estimated four models, adding each new group of characteristics as control variables to region and to those groups of characteristics added previously, to assess the contribution of each group to changes in regional variation. (Refer to Table II.4 for a list of the control variables used in the models.) For each "incremental" model, we computed regression-adjusted, region-specific means from coefficient estimates. A regression-adjusted, region-specific mean estimates a hypothetical average for a region, assuming the measured characteristics of the region were at national averages.[2] By contrast

---

[2]The regression-adjusted mean for the South Atlantic (SA) region, the region excluded from the model is:

$$(1) \quad Mean_{SA} = Mean_{overall} - (b_1 * prop_1 + b_2 * prop_2 + ... + b_8 * prop_8).$$

For each of the eight included regions, the regression-adjusted mean is:

$$(2) \quad Mean_i = Mean_{SA} + b_i,$$

where $i = 1, 8$ for each region, b_i is the marginal impact of region computed from logit coefficients or the actual tobit or ordinary least square (OLS) coefficients, and $prop_i$ is the proportion of episodes from each regions.

To estimate the marginal impact that region i has on the probability of a binary outcome occurring (for example, being admitted to a hospital within 30 days of the end of a home health episode), we compute for each episode (based on a logit model) the predicted probability of the event occurring, first assuming that it was provided by an agency in region i, and then assuming that it was provided by an agency in the reference region (South Atlantic). We then average the differences between these two predicted probabilities across all sample members to obtain the estimated effect of region i relative to the reference region.

(continued...)

unadjusted means account for the region's specific, possibly atypical, characteristics. Finally, we computed the standard deviations of the adjusted and unadjusted region-specific means as a measure of regional variation.

Controlling for patient, area, and agency characteristics could affect regional variation in home health use either by changing the overall level of variation or by changing the patterns of high- and low-use regions observed in the unadjusted means (or both). For characteristics to reduce regional variation, their presence (or absence) must be associated with unusually high (or low) use, the characteristics must differ substantially across regions, and regression adjustment for the characteristics must move region-specific mean home health use closer to the overall mean use. Regional variation will be reduced, either by the means for each region moving somewhat closer to the overall mean or by the means for the high- or low-use regions moving substantially closer to the overall mean.

1. Controlling for Patient, Area, and Agency Characteristics

The bivariate analysis of Chapter III revealed a threefold difference in the use of Medicare home health services between the East South Central region (episodes included 95 visits and were 180 days long, on average) and the Pacific region (episodes included 28 visits and were 60 days long, on average). Home health use was also markedly higher than average in the West South Central region and markedly lower in the Middle Atlantic region.

---

[2](...continued)
The marginal impact of region on number of visits and length of episode is estimated by the coefficient obtained from a tobit model. This is not the usual approach for estimating the marginal effect of an independent variable on the dependent variable in a tobit model. The usual application involves predicting the expected value for the dependent variable based on the predicted probability that the dependent variable is zero, and a predicted value for the dependent variable given that it is greater than zero. Here, however, the tobit model is used only to account for the fact that some observations are truncated. What is desired is the estimated effect of region on episode length and number of visits for the full episode, not simply the observed portion of that episode. The underlying "true" value of the dependent variable is the observed value for nontruncated episodes, and some value Y^* that is greater than the observed value for the truncated stays. The tobit coefficients estimate the effect of explanatory variables on the true value of the dependent variable, which is what we want.

Controlling for patient, area, and agency characteristics reduced the standard deviation of mean visits per episode across regions by about one-third (from 21 to 14) and reduced the standard deviation of mean episode length by nearly one-half (from 38 to 20). (See Table IV.1.)[3] Most of this reduction was a result of controlling for patient and area characteristics, and controlling for agency characteristics led to very little additional reduction. Agency characteristics did not greatly affect regional variation overall because they had an offsetting effect on specific regional means. Agency characteristics, however, were important predictors of visits rendered per episode. (Table IV.2 summarizes the characteristics that had substantial effects on visits rendered per episode and episode length.)[4]

Our multivariate models initially included an indicator of the fiscal intermediary (FI) processing the episode's claims to control for the effect of FI practice on visits rendered and episode length. However, the high correlation of agencies' geographic regions and FI assignments led to distortions in estimation. Table B.2 (Appendix B) illustrates that agencies in most regions were served primarily by one or two FIs.[5] Tables B.3 and B.4 in Appendix B show that mean visits per episode and episode length are reasonably consistent across FIs within region. For example, mean visits per episode and episode length are almost always well above average in the East South Central region, regardless of which FI processed the claims. On the other hand, Tables B.3 and B.4 also show that mean use for region/FI cells with very few episodes deviated widely from the average for the region and for the FI (for example, the three episodes in the East South Central region processed by the Maine FI). Such deviations greatly distorted multivariate models that included FI.

---

[3]In Appendix B, Tables B.5a and B.5b contain estimated coefficients for the models that control for all characteristics.

[4]In Chapter III, we observed relatively little regional variation in the mean number of visits rendered per day. Controlling for patient, area, and agency characteristics had only a slight effect on this variation. (See Appendix B, Table B.6.)

[5]Table A.8 in Appendix A illustrates this for a larger sample.

TABLE IV.1

UNADJUSTED AND REGRESSION-ADJUSTED MEAN HOME HEALTH USE

	Unadjusted Mean	Adjusted for Episode Start Year and Truncation	Adjusted for Episode Start Year and Truncation, Plus:		
			Patient Characteristics	Patient and Area Characteristics	Patient, Area, and Agency Characteristics
Number of Visits per Episode					
New England	52	55 ns	55 ns	58 ns	62
Middle Atlantic	32	33	34	35	39
East North Central	38	39	41	42	42
West North Central	33	34	37	39	40
South Atlantic[a]	53	54	54	52	50
East South Central	95	101	88	83	79
West South Central	62	64	63	57 ns	55 ns
Mountain	45	46	48 ns	49 ns	49 ns
Pacific	27	28	32	36	37
All Regions	47	--	--	--	--
Standard Deviation of Means	21	22	18	15	14
Episode Length (Days)					
New England	97	99 ns	101 ns	111	112
Middle Atlantic	67	68	72	78	78
East North Central	94	95 ns	97 ns	103	102
West North Central	82	83	86 ns	87 ns	87 ns
South Atlantic[a]	94	96	96	91	91
East South Central	186	191	173	146	144
West South Central	119	121	118	100 ns	100 ns
Mountain	79	80	80	81 ns	84 ns
Pacific	59	60	66	83 ns	84 ns
All Regions	95	--	--	--	--
Standard Deviation of Means	38	39	32	21	20
Number of Episodes	19,764				

SOURCES: Medicare 40 Percent Home Health Bill Records (1990-1992); Medicare National Claims History, Standard Analytical Files (1989-1992); Medicare Provider of Services files (1990-1992); Area Resource File (1993).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

The sample used to estimate the models described in this table is a 5-percent random sample of all database episodes that started in 1990 or 1991, less a small number of cases for which control variables were missing.

Tobit was used to estimate the regression models in this table. Tobit compensates for the fact that 3.7 percent of the episodes included in the models upon which this table is based were likely to have been truncated by the data available for building the study's database. Tables B.5a and B.5b contain the tobit coefficient estimates.

Regression-adjusted, region-specific means (episode length or number of visits per episode) were computed as follows:

For the reference region, South Atlantic (SA):

$$Mean_{SA} = Mean_{overall} - (b_1 * prop_1 + b_2 * prop_2 + ... + b_8 * prop_8).$$

For the other regions:

$$Mean_i = Mean_{SA} + b_i$$

where i =1,8 for each of the eight regions other than South Atlantic, b_i is tobit coefficient, and $prop_i$ is the proportion of episodes from each region.

[a] South Atlantic region is the reference region for the regression models.

ns = Difference in means between this region and South Atlantic is not statistically significant (at the .05 level, two-tailed test).

TABLE IV.2

CHARACTERISTICS HAVING A STRONG ASSOCIATION WITH
NUMBER OF VISITS PER EPISODE OR EPISODE LENGTH

Patient Characteristics	Area Characteristics	Agency Characteristics
Number of Visits per Episode		
Nonwhite +	Urban/Rural Status (Relative to Core Counties in Large Metropolitan Areas):[a]	Agency Control (Relative to Nonprofit) Government -
Principal Diagnosis Groups (Relative to Diabetic Care)	Lesser metropolitan + Urbanized nonmetropolitan +	Proprietary +
All groups "." except serious neuromuscular and degenerative diseases, stroke, urinary-tract conditions (including incontinence), anemia, malnutrition/dehydration, ostomy care, care of complicated wounds (including amputations), and peripheral vascular disease		
Comorbid Conditions Neurological diseases + Incontinence + Secondary conditions complicating wound care +		
Prior Service Use Home health visits in the past six months +		
Episode Length		
Nonwhite +	Urban/Rural Status (Relative to Core Counties in Large Metropolitan Areas):[a]	Agency Type (Relative to VNA) Hospital based -
Principal Diagnosis Groups (Relative to Diabetic Care)	Fringe large metropolitan + Medium metropolitan +	Medicare/Medicaid Certification Medicare certified only -
All groups "." except urinary-tract conditions, anemia, ostomy care	Lesser metropolitan + Urbanized nonmetropolitan + Less urbanized nonmetropolitan + Thinly populated +	
Comorbid Conditions Congestive heart failure + Neurological diseases + Malnutrition/dehydration + Incontinence +	Proportion of Elderly Living in Poverty +	
Prior Service Use Home health visits in the past six months + Postacute -		

SOURCES: Medicare 40 Percent Home Health Bill Records (1990-1992); Medicare National Claims History, Standard Analytical Files (1989-1992); Medicare Provider of Services files (1990-1992); Area Resource File (1993).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

The characteristics in this table are based on coefficient estimates from tobit regressions of number of visits per episode and episode length; these estimates appear in Tables B.5a and B.5b. Estimation was carried out on a 5-percent random sample (19,764) of database episodes starting in 1990 or 1991.

TABLE IV.2 *(continued)*

Characteristics represented by binary variables were listed here if they were statistically significant at the .05 level and (1) they had roughly a 10-percent or greater effect on the dependent variable (that is, were associated with an increase or decrease of five or more visits or 10 or more days), or (2) they were associated with a slightly smaller change but varied greatly across regions. Characteristics represented by continuous variables (for example, home health visits prior to the study episode) were listed if they were statistically significant at the .05 level, and a one-standard deviation change in the variable was associated with an increase or decrease of 10 percent in the dependent variable.

"+" means an increase in the characteristic was associated with an increase in the dependent variable; "-" means an increase in the characteristic was associated with a decrease in the dependent variable. For example, the greater the number of home health visits the beneficiary received during the six months prior to the study episode, the more visits he/she was likely to receive during the study episode and the longer the study episode was expected to be.

[a]Urban/rural status categories come from the Department of Agriculture (as found on the Area Resource File) and were defined as follows:

Large metropolitan, core counties: core counties of greater Standard Metropolitan Statistical Areas (SMSAs) of one million or more population

Large metropolitan, fringe counties: noncore counties of metropolitan areas of one million or more population

Medium metropolitan: counties of metropolitan areas of 250,000 to 999,999 population

Lesser metropolitan: counties of metropolitan areas of less than 250,000

Urbanized nonmetropolitan: counties outside SMSAs having 20,000 or more residents commuting to urban areas

Less urbanized nonmetropolitan: counties outside SMSAs having 2,500 to 19,999 residents commuting to urban areas

Thinly populated: counties outside SMSAs having less than 2,500 residents commuting to urban areas

As illustrated below, regional home health use clusters into high- and low-use groups that change somewhat after controlling for patient, area, and agency characteristics:

	Mean Use by Region Prior to Regression Adjustment	Mean Use by Region Following Regression Adjustment
High-Use Regions	East South Central (95 visits, 186 days)	East South Central (79 visits, 144 days)
	West South Central (62 visits, 119 days)	New England (62 visits, 112 days)
Low-Use Regions	Pacific (27 visits, 59 days)	Pacific (37 visits, 84 days)
	Middle Atlantic (32 visits, 67 days)	Middle Atlantic (39 visits, 78 days)

East South Central. Home health use was highest for patients in the East South Central region prior to controlling for the three groups of characteristics and remained highest after controlling for them. However, regression adjustment reduced the mean number of visits per episode for the region by 17 percent and mean episode length by 23 percent. Controlling for patient characteristics accounted for a great deal of the reduction, partly because patients of home health agencies in the East South Central region were more likely to be nonwhite, to have had high levels of home health use prior to study episodes, and to have been more chronically ill and frail than elsewhere; these characteristics are all associated with higher than average home health use (as discussed in Chapter II and reflected in Table IV.2). Controlling for area characteristics further reduced mean episode length and, to a lesser extent, visits rendered per episode. This is partly due to a relatively high proportion of episodes occurring in urbanized nonmetropolitan counties, which also tended to have longer episodes and more visits than average. In addition, agencies in this region were delivering care in counties with unusually high levels of poverty among elderly residents: 21 percent of episodes were delivered in such counties, as compared with 12 percent nationally. Controlling for agency characteristics further reduced the mean number of visits rendered per episode, as a result of the high proportion of proprietary agencies in the region (50 percent, as compared with 31 percent nationally). (Proprietary agencies provided an average of 14 more visits per episode than did nonprofit agencies.)

West South Central. Prior to regression adjustment, the West South Central region had the second highest home health use. After controlling for the available characteristics, however, home health use in this region did not differ significantly from that of the reference region for the analysis, the South Atlantic, which had use levels roughly at the national means. The primary reductions in mean home health use in this region accrued from controlling for area characteristics. The West South Central region had a relatively high proportion of episodes delivered in lesser metropolitan counties (which also tended to have above-average home health use) and an unusually high proportion of elderly persons living in poverty.

New England. New England emerged as the region with the second highest use after controlling for available characteristics. Prior to regression adjustment, its use levels were just above the national means. In New England (unlike most other regions), agency characteristics were associated with the greatest increase in adjusted mean visits per episode. New England had the lowest proportion in the country of episodes provided by proprietary agencies (10 percent, compared with 31 percent nationally). Area characteristics were associated with the greatest increase in adjusted mean episode length for the region. New England had a markedly lower proportion of elderly persons living in poverty.

Pacific. Home health use was the lowest in the Pacific region prior to controlling for available characteristics, but regression adjustment increased mean episode length by 42 percent and increased mean visits per episode by 37 percent. Thus, while the Pacific region still had the lowest mean visits per episode after regression adjustment, mean episode length was not statistically distinguishable from the mean for the South Atlantic region. Patient and area characteristics were associated with the greatest increases in adjusted mean home health use. The Pacific region had home health patients who were less frail than most regions, the highest proportion of episodes rendered in core counties of large metropolitan areas (which tended to have below-average home health use), and the lowest proportion of elderly living in poverty of any region.

Middle Atlantic. In the Middle Atlantic region, regression adjustment increased mean episode length by 16 percent and visits per episode by 22 percent. However, it remained a low-use region. Agency characteristics were associated with the biggest increase in mean visits per episode. Like New England, the Middle Atlantic region had relatively few episodes delivered by proprietary agencies and a somewhat higher than average proportion of episodes delivered in core counties of large metropolitan areas.

East and West North Central. The number of mean visits rendered per episode in the East and West North Central regions was also relatively low (38 and 33 visits, respectively, prior to regression adjustment). Mean episode length, however, was somewhat higher than in the Pacific and Middle Atlantic regions (94 and 82 days, respectively, prior to regression adjustment). Regression adjustment slightly increased mean visits per episode for the East North Central region (to 42 visits) and modestly increased them for the West North Central region (to 40 visits). The increase was primarily associated with regional differences from the overall means in patient and area characteristics. In particular, patients in the West North Central region had below-average levels of home health use prior to study episodes (lower prior use was associated with lower use during study episodes). Characteristics for the East North Central region were generally close to overall means.

Summary. Controlling for patient, area, and agency characteristics substantially reduced regional variation in mean visits per episode and episode length, but did not eliminate it, suggesting--not surprisingly--that factors other than the patient, area, and agency characteristics culled from secondary data affect regional patterns of home health use. These factors may include medical practice patterns, the availability of residential and home- and community-based alternatives to Medicare home health, or other patient-specific characteristics such as level of functioning, compliance with recommended treatment regimens, and the availability of informal care. FI practice did not seem to be a major contributor to regional variation, although we could not assess its effect with multivariate analysis because of the correlation between FI and region.

Adjusting for patient characteristics, and, to a lesser extent, for area and agency characteristics, greatly reduced the extremely high home health use rate of the East South Central region. This reduction reflects the region's unusually high proportion of frail "long-term care" type patients who reside in highly impoverished areas and its concentration of proprietary agencies. Patient characteristics contributed relatively little to changes in mean use in other regions except for the Pacific, in which home health patients seemed to be less frail. Instead, area characteristics (such as the distribution of episodes among metropolitan and nonmetropolitan counties and, to a lesser extent, the level of poverty among the elderly) accounted for most change in home health use. Agency characteristics (particularly agency control) accounted for substantial change in only a few regions in which the proportions of episodes provided by proprietary agencies deviated most from the national mean.

2. Condition-Specific Models

We reestimated the models of visits rendered per episode and episode length using subsamples of episodes for patients with each of three conditions seen frequently by Medicare home health agencies--diabetes, serious cardiopulmonary disorders (including congestive heart failure and acute myocardial infarction), and stroke or serious neuromuscular and degenerative disorders (including Parkinson's and Huntington's diseases)--to see if patients with the same conditions received roughly the same levels of home health care in different parts of the country.[6] In other words, we wished to see whether regional differences in home health practice for these common conditions drive the observed overall regional differences. We drew condition-specific subsamples for these models from the full sample of episodes that started in 1990 or 1991 because condition-specific subsamples from the 5-percent random sample were too small.

---

[6]These conditions were identified using a classification system that groups principal diagnoses into categories according to the type and amount of home health care typically used for them. (See Table A.3 and Exhibit A.1 in Appendix A.)

Nationally, patients receiving home health care who had a principal diagnosis of diabetes or stroke/serious neuromuscular disorders received markedly more visits per episode and had longer episodes than average, while patients with serious cardiopulmonary conditions received care slightly below average levels. (See Table IV.3.)

Regional patterns of home health use among episodes restricted to these conditions were largely the same as those for the more heterogenous sample discussed above, both prior to and following regression adjustment for available characteristics. (See Appendix B, Tables B.7 through B.9.) For example, following regression adjustment, for each condition the standard deviation of the region-specific means of visits per episode was reduced by approximately one-third, and that for the region-specific means of episode length was reduced by just under one-half, just as they were for the sample of episodes for patients with all types of conditions.[7]

Similarly, the patterns of high- and low-use regions before and after regression adjustment were roughly the same for each of the condition subsamples as for the larger sample of all conditions. In the East South Central region, for each of the three conditions, regression adjustment reduced the mean visits per episode and episode length, although the region continued to have the highest use.[8] While regression adjustment increased use in the Middle Atlantic and Pacific regions for each of the conditions, they remained the regions with the lowest use.

We conclude that region-specific care for these three conditions was generally the same as care overall. Regions that typically provided higher levels of care provided higher levels to patients with these conditions, while regions that typically provided lower levels of care provided lower levels to these patients.

---

[7]The standard deviations of the region-specific means of visits rendered per day were low for each condition and changed little following regression adjustment. This is similar to the pattern observed for the more heterogenous sample.

[8]For episodes with a principal diagnosis of stroke/serious neuromuscular disorders, however, regression adjustment caused New England to surpass the East South Central region in having the highest number of visits per episode.

TABLE IV.3

VISITS RENDERED AND EPISODE LENGTH BY CONDITION SUBGROUP

	Diabetes	Serious Cardio-pulmonary	Stroke/ Serious Neurological or Degenerative	All Episodes Starting in 1900/1991
Number of Visits per Episode				
Mean	63.8	41.8	63.9	46.5
Median	18	16	24	16
Mean Number of Visits per Day	0.48	0.47	0.60	0.52
Episode Length (Days)				
Mean	135.8	93.0	107.9	94.1
Median	55	47	51	43
Episode Length (Percent Distribution)				
1 to 30 days	30.6	34.0	31.2	37.2
31 to 60 days	25.8	31.3	29.0	29.1
61 to 90 days	9.9	10.1	10.8	9.7
91 to 180 days	13.1	12.2	13.9	11.5
181 to 365 days	8.5	6.4	7.2	6.0
More than 365 days	12.1	6.0	7.9	6.5
Number of Episodes	27,114	43,627	27,864	398,522

SOURCE: Medicare 40 Percent Home Health Bill Records (1990-1992).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

The conditions used in this table were identified using a classification system that groups principal diagnoses into categories according to the types and amount of home health care to which they typically give rise. (See Exhibit A.1 for a list of all 46 categories generated by the system.) Serious cardiopulmonary conditions include congestive heart failure and acute myocardial infarction; serious neurological and degenerative disorders include Parkinson's and Huntington's diseases.

3. Controlling for Treatment Plan Data

We estimated multivariate models controlling for treatment plan data as a fourth incremental group of characteristics for the subsample of episodes that could be merged to the RHHI database to gauge the effect of treatment plan data on regional patterns of home health use.[9] Data from treatment plans may proxy patient characteristics as well as agency practice. Regression adjustment for treatment plan data reduced only marginally overall regional variation in mean visits per episode and episode length and changed mean use for several regions, but usually by less than 5 percent. (See Appendix B, Table B.10.) The exception was the Mountain region, in which the number of mean visits rendered per episode was reduced by 10 percent, primarily because this region had above-average levels of some home health aide services associated with increased visits (help with personal care and help with tub bathing). Therefore, although bivariate analysis revealed some cross-region variation in functional limitations and planned treatments, and although some treatments were associated with above-average home health use, controlling for treatment plan data did not change patterns of regional variation. This is probably because patient and agency characteristics already accounted for most of the treatment plan differences.

B. THE EFFECTS OF CHARACTERISTICS ON REGIONAL VARIATION IN PATIENT OUTCOMES POTENTIALLY RELATED TO HOME HEALTH

We estimated logit models of the likelihood of six patient outcomes potentially related to home health care as the function of region and patient, area, and agency characteristics. The models allowed us to assess whether controlling for these characteristics changed the relative lack of regional variation in patient outcomes or affected regional outcome patterns observed in bivariate analysis.

---

[9]Multivariate models discussed in this section were estimated with ordinary least squares (OLS) regression. The iterative nature of tobit limits the number of control variables that may be included in models. We had 103 variables from the treatment data to examine in addition to the 90 variables of patient, area, and agency characteristics. To avoid making arbitrary decisions about which variables to include in this exploratory analysis, we used OLS estimation and kept all the control variables. Comparisons of OLS and tobit estimates for the models discussed in subsection A.1 were very close. Conclusions regarding regional variation in home health use drawn from OLS estimates would have been identical to those from tobit estimation.

The outcomes were (1) whether the patient entered an inpatient hospital within 30 days of the end of the home health episode, (2) whether that admission was for the same general diagnosis as the home health admission, (3) whether the patient had a home health readmission between 31 and 60 days after the original episode, (4) whether that readmission was for the same general diagnosis as the original admission, (5) whether the patient entered a SNF within 30 days of the end of the home health episode, and (6) whether the patient died within 30 days of the end of the episode. We used logit coefficient estimates to compute region-specific, regression-adjusted means (as described in Section A), for which we subsequently computed standard deviations. To ensure that the events designated as outcomes actually occurred after, and not during, possibly ongoing episodes, the sample for this estimation was restricted to episodes that were complete as of December 1992.[10]

Bivariate analysis revealed relatively little cross-region variation in patient outcomes. Rates of inpatient admission and mortality following home health episodes were somewhat higher in the East South Central region (largely due to the greater frailty of home health patients in that region), but were somewhat lower in the Pacific region. Rates of SNF admission following home health were somewhat higher in the West North Central, Mountain, and Pacific regions, which also had above-average SNF use prior to home health, suggesting that SNF care was used more widely in these regions. Rates of home health readmission showed the greatest regional variation and a cross-region pattern similar to that for home health use during study episodes: highest readmission rates in the East South Central region and lowest readmission rates in the Pacific, Middle Atlantic, and West North Central regions.

Controlling for characteristics slightly increased the standard deviation of the region-specific probabilities of having a hospital admission within 30 days of the end of the home health episode.

---

[10]See Appendix B, Table B.11, for a comparison of region-specific probabilities of patient outcomes for the 5-percent analysis sample with probabilities for the sample of all *completed* episodes starting in 1990 or 1991. For most of the outcomes examined, probabilities for the subsample differed by less than 1 percentage point from those for the full sample from which it was drawn.

(See Table IV.4.) (The overall rate of inpatient admission was 22 percent.) In the East South Central region, regression adjustment reduced the likelihood of an inpatient admission following home health by 3 percentage points, while it increased the likelihood by 2 percentage points in New England and the Mountain region.[11] As a result, for this sample the rate of inpatient admission for the East South Central region was statistically equivalent to those of the South Atlantic, West South Central, Pacific, Mountain, and Middle Atlantic regions.[12]

Regression adjustment reduced the already modest variation in mortality rates by half and reduced the mortality rate for the region with the highest rate, the East South Central, from 16 to 13 percent. (The overall rate was 13 percent.) After regression adjustment none of the region-specific mortality rates differed significantly from that of the reference region.

Regression adjustment reduced the cross-region standard deviation of the probabilities of having a home health readmission by approximately 25 percent. (The overall rate was 12 percent.) Regression adjustment also reduced the likelihood of a home health readmission in the high-use East and West South Central regions by 6 and 3 percentage points, respectively, while increasing the likelihoods in New England and the Middle Atlantic region between 2 and 3 percentage points. The East South Central region still had the highest readmission rates, but the Pacific and Middle Atlantic regions no longer had the lowest rates (although they remained below average).

---

[11]For episodes in the East South Central region in the full sample, the inpatient admission rate was 26 percent and was the highest rate of all regions, while in the 5-percent sample, the rate was only 23 percent, putting it below five other regions. We estimated the inpatient admission model on the full sample using OLS. Regression adjustment from these estimates had the same effect on regional variation as did that from the logit model estimated on the 5-percent sample: the likelihood for the East South Central region decreased by a few percentage points, while the likelihoods for New England and the Mountain region increased.

[12]Regional patterns of inpatient admission and home health readmission for the same general principal condition that was present at the start of the original home health episode were similar to those for inpatient admissions and home health readmissions generally. (See Appendix B, Table B.12.)

TABLE IV.4

UNADJUSTED AND REGRESSION-ADJUSTED PROBABILITIES OF PATIENT OUTCOMES BY REGION
(Percentages)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic[a]	East South Central	West South Central	Mountain	Pacific	Standard Deviation (Overall Mean)
Inpatient Admission Within 30 Days of Episode End										
Unadjusted Mean	23.5	23.3	24.6	24.0	19.9	23.0	23.3	20.3	19.7	1.8 (22.3)
Adjusted for Episode Start Year, Patient, Area, Agency	25.3	22.1 ns	24.7	25.5	20.0	20.2 ns	22.2 ns	22.0 ns	21.6 ns	2.1
Died Within 30 Days of Episode End										
Unadjusted Mean	12.8	11.4	13.5	12.4	11.9	15.5	13.2	12.5	11.9	1.2 (12.6)
Adjusted for Episode Start Year, Patient, Area, Agency	12.7 ns	11.6 ns	13.4 ns	12.3 ns	12.2	13.2 ns	13.3 ns	12.2 ns	12.6 ns	.6
Home Health Readmission Between 31 and 60 Days After Episode End										
Unadjusted Mean	16.4	8.4	10.3	8.4	11.1	21.4	13.0	12.1	8.9	4.3 (11.5)
Adjusted for Year, Patient, Area, Agency	18.5	11.0 ns	11.6 ns	8.8 ns	10.7	15.6	9.7 ns	10.1 ns	9.6 ns	3.2
SNF Admission Within 30 Days of Episode End										
Unadjusted Mean	3.7	2.7	4.9	5.6	3.3	5.0	4.3	6.1	5.8	1.2 (4.3)
Adjusted for Episode Start Year, Patient, Area, Agency	3.9 ns	2.8 ns	4.8	5.6	3.3	5.1	4.3 ns	5.3	5.6	1.0
Number of Episodes	1,361	3,324	2,878	1,172	3,712	1,526	1,831	769	2,464	19,037

TABLE IV.4 *(continued)*

SOURCES: Medicare 40 Percent Home Health Bill Records (1990-1992): Medicare National Claims History, Standard Analytical Files (1989-1993); Medicare Provider of Services files (1990-1992); Area Resource File (1993).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

The sample used to estimate the models described in this table is a 5-percent random sample of all database episodes that started in 1990 or 1991 and that were complete prior to December 1992, less a small number of cases for which control variables were missing.

Logit was used to estimate the regression models in this table. Logit estimates regression models for which the dependent variable is a binary, rather than continuous, measure.

Regression-adjusted, region-specific probabilities (mean) were computed as follows:

For the reference region, South Atlantic (SA):

$$Mean_{SA} = Mean_{overall} - (b_1 + b_2 * prop_2 + ... + b_8 * prop_8).$$

For the other regions:

$$Mean_i = Mean_{SA} + b_i$$

where $i = 1,8$ for each of the eight regions other than South Atlantic. b_i is marginal impact computed from logit coefficients, and $prop_i$ is the proportion of episodes from each of the regions. To estimate the marginal impact that region i has on the probability of a binary outcome occurring (for example, being admitted to a hospital within 30 days of the end of a home health episode), we compute for each episode (based on a logit model) the predicted probability of the event occurring, first assuming that it was provided by an agency in region i, and then assuming that it was provided by an agency in the reference region (South Atlantic). We then average the differences between these two predicted probabilities across all sample members to obtain the estimated effect of region i relative to the reference region.

[a]South Atlantic region is the reference region for the regression models.

ns = Difference in means between this region and South Atlantic is not statistically significant (at the .05 level, two-tailed test).

Regression adjustment reduced the standard deviation of region-specific rates of SNF admission following home health very little. Moreover, even after regression adjustment, the West North Central, Mountain, and Pacific regions still had the highest rates of admission, suggesting that the use of SNFs in these regions had more to do with medical practice than specific patient, area, and agency characteristics.

Summary. Although regional variation in patient outcomes potentially related to home health was not great to begin with, regression adjustment did reduce the standard deviations of region-specific mortality by one-half and of home health readmission rates by one-quarter. Regression adjustment also brought the relatively higher rates of mortality and home health readmission (and inpatient admission) in the East South Central region much closer to the overall means, underscoring the unusual frailty and poorer health of home health patients in that region. However, regression adjustment did not alter the conclusion of bivariate analysis that extremes of home health use do not seem to be related to high rates of either adverse or favorable patient outcomes.

C. CHARACTERISTICS OF LONG EPISODES

Bivariate analysis showed that geographic regions with the highest mean numbers of visits rendered per episode also had the highest percentages of episodes longer than a year. For example, in the "high-use" East South Central region, episodes included a mean of 95 visits, and 18 percent of all episodes were longer than a year. (See Table III.1.) By contrast, in the two lowest-use regions, the Middle Atlantic and Pacific, episodes averaged 30 and 28 visits, respectively, but only 3 percent of episodes were longer than a year. Because mean number of visits per day was virtually identical for all three regions, episode length could be said to "explain" some of the regional variation in visits per episode. In fact when, for expository purposes, episode length was included as a control variable in the tobit model for number of visits per episode presented in Table IV.1, the standard deviation of the region-specific, regression-adjusted means was reduced by nearly another 50 percent (from 14 to 8) relative to the model that controlled only for patient, area, and agency characteristics.

The importance of episode length in "explaining" regional variation in visits rendered per episode leads to two questions: (1) What are the characteristics of patients, areas, and home health agencies associated with very long episodes? and (2) Do these characteristics vary for high- and low-use regions? To address these questions, we estimated logit models of the probability of an episode being longer than a year. This estimation was carried out separately for each of the nine regions and for all regions together. Because the 5-percent sample was too small for the region-specific models, the analysis sample for this estimation included all episodes that started in 1990 or 1991. We then compared sizable, statistically significant coefficient estimates overall and across regions to identify characteristics of episodes longer than a year and any differences in those characteristics for high- and low-use regions.

Nationally, episodes on the study database that lasted longer than one year included an average of 295 visits and were roughly 20 months long. Moreover, of the 25,914 episodes on the database that were longer than one year, 56 percent were ongoing in December 1992 and thus were truncated by the available data. Skilled nurses provided 51 percent of the visits and home health aides provided 44 percent (compared with 64 and 20 percent, respectively, for episodes of all lengths).

Overall, patients with very long episodes were characterized by age, gender, certain diagnoses, and whether they started out using home health as postacute care. (See Table IV.5.) These patients were more likely to be younger than 65 and/or to be female. Only patients with primary diagnoses of anemia or urinary-tract problems (including incontinence) were more likely than patients with diabetes to have episodes longer than a year. Patients with serious neuromuscular and degenerative diseases were as likely as those with diabetes to have very long episodes, while patients with all other conditions were less likely than diabetics to have such episodes. As we saw earlier (Table IV.3), patients with diabetes had home health episodes that were 45 percent longer than average (136 days, compared with 94 overall) and were about twice as likely, on average, to have episodes that lasted over a year (12 percent, compared with 7 percent overall). Thus, it is not surprising that patients with

64

TABLE IV.5

CHARACTERISTICS ASSOCIATED WITH A SUBSTANTIALLY INCREASED PROBABILITY OF
HAVING A HOME HEALTH EPISODE LONGER THAN ONE YEAR

	Patient Characteristics				Area Characteristics	Agency Characteristics
	Demographic	Principal Diagnosis Group (Relative to Diabetes)	Comorbid Conditions	Prior Service Use		
Characteristics of Long Episodes Nationally	Female + Age less than 65 + (Relative to age 65-74)	Anemia + Urinary-tract conditions (including incontinence) + Serious neuromuscular/ degenerative conditions = (All other groups "-" relative to diabetes)	Dementia + Diabetes + Neurological diseases + Incontinence + Cancer -	Postacute -	Urban/rural status (relative to core counties in large metropolitan areas) All categories +	Agency type (relative to VNA) Hospital based - Medicare/Medicaid certification Medicare certified only -
"Higher-Use" Regions						
East South Central	Age less than 65 =	Urinary conditions = Less serious cardio = Acute or serious resp = Mental difficulties = Serious neuromuscular -	Peripheral vascular disease + Depression - Neurological =		Urban/rural status[a] Annual Medicare reimbursement +	Agency type (relative to VNA) Hospital based = Freestanding + Medicare/Medicaid certification Medicare-certified only =
West South Central	Age greater than 84 + Nonwhite +	Anemia = Urinary conditions = Serious neuromuscular -	Congestive heart failure + Peripheral vascular disease + Paralysis - Conditions complicating wound healing -	Home health visits in six months prior to episode +	Annual Medicare reimbursement +	

TABLE IV.5 *(continued)*

	Patient Characteristics				Area Characteristics	Agency Characteristics
	Demographic	Principal Diagnosis Group (Relative to Diabetes)	Comorbid Conditions	Prior Service Use		
New England	Age less than 65 =	Serious neuromuscular + Urinary conditions = Less serious cardio = Acute or serious resp = Ostomy care = Stroke = Hypertension = Peripheral vascular =	Peripheral vascular disease + Cancer =		Annual Medicare reimbursement +	Agency type (relative to VNA) Hospital based = Medicare/Medicaid certification Medicare certified only =
"Lower-Use" Regions						
Pacific		Serious neuromuscular + Acute or serious resp = Ostomy care + Mental difficulties = Stroke = Peripheral vascular = Complicated wound care or amputation =	Chronic obstructive pulmonary disease + Peripheral vascular + Dementia = Paralysis -	Post-SNF - Home health visits in six months prior to episode +	Urban/rural status (relative to core counties in large metropolitan areas) All categories = Annual Medicare reimbursement - Proportion of elderly living in poverty +	Agency type (relative to VNA) Hospital based = Agency control (relative to nonprofit) Proprietary + Medicare/Medicaid certification Medicare certified only =
Middle Atlantic	Female =		Dementia = Depression -	Post-SNF - Home health visits in six months prior to episode +	Proportion of elderly living in poverty +	Agency control (relative to nonprofit) Proprietary + Government - Medicare/Medicaid certification Medicare certified only +

66

TABLE IV.5 *(continued)*

SOURCES: Medicare 40 Percent Home Health Bill Records (1990-1992); Medicare National Claims History, Standard Analytical Files (1989-1992); Medicare Provider of Services files (1990-1992); Area Resource File (1993).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

The characteristics in this table are based on coefficient estimates from logit models of whether episodes were longer than a year, run separately for each region and for all regions together. Estimation was carried out on all episodes starting in 1990 or 1991, less a small number for which control variables were missing; the estimation sample size was 393,091.

Characteristics represented by binary variables were listed in the overall panel if they were statistically significant at the .01 level and had odds ratios less than .8 or greater than 1.2 in the all-region model. Characteristics represented by continuous variables (for example, home health visits prior to the study episode) were listed if they were statistically significant at the .01 level and a one-standard deviation change in the variable was associated an odds ratio less than .8 or greater than 1.2. (It was necessary to use .01 rather than .05 because the sample sizes were so large that almost all coefficient estimates were statistically significant at the .05 level.)

"+" means episodes with the characteristic had an increased probability of being longer than a year; "−" means episodes with the characteristic had a decreased probability of being longer than a year; "=" means episodes with a characteristic that was part of a mutually exclusive and exhaustive group had the same probability of being longer than a year as the omitted category for the group. For example, overall, females were more likely than males to have a long episode, while patients with serious neuromuscular conditions were just as likely as diabetics to have a long episode.

The "higher-use" and "lower-use" regions in the lower panels shared the characteristics of the national sample unless noted in these panels.

[a]There were no episodes in our database for the East South Central region provided by agencies located in core counties of large metropolitan areas. For the East South Central region, the reference category for urban/rural status was "thinly populated" counties. Agencies in medium and lesser metropolitan areas and urbanized and less urbanized nonmetropolitan areas were all more likely to provide episodes longer than a year than were agencies in thinly populated counties. Agencies in fringe counties of large metropolitan areas were less likely to provide episodes longer than a year than were agencies in thinly populated counties.

only a few other diagnoses (specifically those with anemia or urinary-tract problems) were more likely than diabetics to have very long episodes. Several comorbid conditions (dementia, diabetes, a neurological condition, or incontinence) also put patients at higher risk of very long home health episodes. Patients with episodes longer than a year also were *less likely* to have a secondary diagnosis of cancer or to have started out using home health as postacute care (that is, to have had a hospital stay that ended within two weeks of the start of home health).

Agencies providing very long episodes were more likely to be outside core counties of large metropolitan areas. If core counties of large metropolitan areas had a greater supply of resources that could substitute for long-term home health care (for example, personal care, housekeeping, home-delivered meals, assisted-living facilities), agencies in these areas could terminate episodes earlier, whereas if no alternative resources were available, agencies might continue to see patients for as long as possible.

Agency control did *not* affect the likelihood of an episode lasting longer than a year, even though it was associated with differences in mean visits rendered per episode. (See Table IV.2.) However, hospital-based agencies were less likely than VNAs to provide episodes that lasted for more than a year. Agencies that were not Medicaid-certified were also less likely than those that were to provide very long episodes.

Thus, patients with episodes longer than one year emerge as frail, debilitated, and functionally impaired enough to require substantial assistance from home health aides. Very long episodes tend to be provided outside core counties of metropolitan areas.[13]

Regional Differences. One might hypothesize that particular medical conditions (or other characteristics) underlie the regional differences in the probability of having an episode of longer than a year (for example, that provision of care over atypically long periods for patients with selected

---

[13]Patients with episodes of less than one year had roughly the same characteristics associated with increased visits as patients with episodes of any length. These characteristics are shown in Table IV.2.

conditions is what makes episodes so long in the East South Central region). However, this does not seem to be the case. Consistent with the findings from the condition-specific models of home health use, the high-use regions generally provide more care to patients with all kinds of conditions, and the low-use regions provide less care. The national portrait of very long episodes carries over to the high- and low-use regions. Only a few exceptions consistently affected more than one region.

The first exception concerns patients who enter home health immediately following a SNF stay. In the low-use regions, the Pacific and Middle Atlantic, patients using home health for *post-SNF* care had a decreased risk of having a home health episode longer than a year, whereas use of post-SNF care had no effect on this risk overall or in the high-use regions. It seems reasonable that use of home health for post-SNF care would be transitional and relatively short term. However, it is unclear why this should be the case only in the Middle Atlantic and Pacific regions, one of which (Pacific) had an unusually high rate of post-SNF home health episodes, while the other had an unusually low rate.

The second exception to the national portrait of very long episodes concerns area characteristics: annual levels of Medicare expenditures and urban/rural status. Increased average annual Medicare reimbursement for the county where the agency was located was associated with increased risk of very long episodes in the three high-use regions, but with decreased risk in the Pacific region. High levels of Medicare spending may be an indicator of the poorer health of residents in the high-use regions or may reflect medical practice patterns. Nationally, episodes provided by agencies outside core counties of large metropolitan areas were more likely than those provided within such counties to be very long. In the low-use Pacific region, however, urban/rural status had no discernible effect on the likelihood of an episode lasting longer than a year, suggesting services that could be alternatives to long-term home health might be uniformly available across the region, regardless of how rural the area. Given the portrait of home health users in this region as less frail than average, it seems likely that the most frail beneficiaries in the Pacific region never enter home health, but may go to SNFs

or other residential settings. (The Pacific region had among the highest rates of SNF admission both prior to and following home health.) Those that do enter home health may leave earlier and then move on to SNFs or other residential settings or to home- and community-based programs funded outside the Medicare system.

The final exception to the national portrait of long episodes concerns agency characteristics. Overall, and among the high-use regions, agency control had no discernible effect on the probability of having an episode longer than a year (although, relative to nonprofit agencies, proprietary agencies provided a substantially greater number of visits both for episodes of any length and for episodes of less than a year long). Among the two low-use regions, however, episodes provided by proprietary agencies were more likely to be very long. It is not clear why this should be the case. Perhaps proprietary agencies in these regions employ greater numbers of home health aides than nonprofit agencies and thus are more able than nonprofit agencies to provide long-term care. Alternatively, they may be overproviding care in these regions.

V. CONCLUSIONS AND RECOMMENDATIONS

Over the past 10 years, growth in the use of the Medicare home health benefit has increased disproportionately to other sectors of the Medicare budget. Some of this growth was expected, as the need increased for home health to provide postacute care in the wake of prospective payment for inpatient services. Additional growth was expected as home health was made more widely available, following the clarifications of Medicare regulations in response to the Duggan *v.* Bowen lawsuit. Nonetheless, the extraordinary growth in the use of the benefit and in the growth of home health as an industry has caught the attention of policymakers. Striking regional variation in the levels of care received by home health patients leads to questions about whether more home health care than appropriate is provided in some areas and less care than appropriate in others.

In this study we begin to address two primary questions: (1) Why does the use of home health care vary so widely across regions? and (2) Is there a corresponding variation across regions in patient outcomes that suggests lower levels of care lead to poorer outcomes for patients or higher levels lead to improved outcomes? We addressed these questions by analyzing a database of secondary data that described patients prior to, during, and immediately following home health episodes; the agencies providing them care; and the service environments of counties in which the agencies were located.

Secondary data are limited because they provide only crude descriptions of home health patients, agencies, and service environments. The analysis itself must be viewed as preliminary because it can only identify associations between home health use, potential patient outcomes, and characteristics, from which we can conjecture about the causes of regional variation. It cannot determine the specific reasons underlying regional variation. However, with these caveats, this analysis provides a reasonable starting point for investigating the questions at hand.

Home Health Use. The study database showed a threefold difference in the use of Medicare home health services between the East South Central region (in which episodes included 95 visits and

lasted 180 days, on average) and the Pacific region (in which episodes included 28 visits and lasted 60 days, on average). Overall, adjusting for differences in patient, area, and agency characteristics reduced the between-region standard deviation of visits rendered per episode by one-third and that for episode length by one-half. Most of these reductions came from controlling for patient and area characteristics; agency characteristics added little more to the explanation of regional variation once we accounted for patient and area characteristics.

After accounting for differences in patient and area characteristics, we found that average per-episode home health use for the East South Central region (the region with the highest number of visits per episode) was much closer to the overall mean. Compared with Medicare home health users nationally, those in the East South Central region *were much more frail, chronically ill, and in poorer health* (as characterized by higher incidences of incontinence, malnutrition, and dyspnea; diagnoses of diabetes and hypertension or cerebrovascular disease; planned use of the skilled nursing treatment venipuncture; and greater use of home health services prior to study episodes). Episodes in the East South Central region tended to be delivered *outside large metropolitan* counties and in counties that had unusually high proportions of *elderly persons living in poverty* (both characteristics associated with higher than average home health use). Higher home health use in nonmetropolitan areas may have been the result of fewer affordable residential or community-based alternatives to home health care (such as personal care and homemaker programs, home-delivered meals, or assisted-living facilities). There might have been a need, therefore, for home health agencies to serve patients over a longer time period. Higher use in high-poverty areas may result from patients who lack funds to purchase the numerous medications the chronically ill elderly need or to purchase food consistent with recommended diets needed to stabilize patients with chronic illness. Elderly people with low incomes are also less able to pay for services (such as homemaker services) that help them adhere to diet and medication regimens and maintain medical stability. Thus, home health agencies in high-poverty areas are likely to be dealing with continually medically unstable patients.

By contrast, controlling for patient and area characteristics greatly increased the estimated adjusted-average home health use for the Pacific region, because patients and environments in the Pacific were so unlike those in the East South Central region. Patients were less frail and less likely to be chronically ill. The areas in which home health was provided were more likely to include large metropolitan counties and have unusually low levels of elderly persons living in poverty. It seems likely that, in the Pacific region, many of the most frail Medicare beneficiaries did not become home health patients at all; perhaps they entered SNFs or other assisted-living environments. Those frail beneficiaries in the Pacific region who did enter home health may have moved to SNFs or to less-skilled residential or home- and community-based programs relatively quickly, rather than becoming long-term home health users.[1]

Thus, the Medicare home health benefit as implemented in these two regions emerges like the Roman gatekeeper Janus, facing in two opposite directions at once: it provides long-duration care for very frail beneficiaries who have no alternative sources of care and shorter-term care for more acutely ill beneficiaries who move on to other programs if long-term care is needed. Moreover, this regional difference was not limited to patients who had only a few specific medical problems, but prevailed more generally.

Although controlling for agency characteristics did not further reduce the between-region variation in home health visits per episode (after controlling for patient and area characteristics), it did play a role in reducing mean visits per episode for the East South Central region (and increasing that mean for New England and the Middle Atlantic region). These changes occurred because the East South Central region had an atypically high proportion of episodes delivered by proprietary agencies (while the Middle Atlantic and New England regions had atypically low proportions) and

---

[1] In 1986, each state in the Pacific region spent more on home- and community-based care per elderly resident than did any of the East South Central states (Feder 1991). Thus, alternate care may be more widely available in the Pacific region.

73

because proprietary agencies provided an average of 30 percent more visits per episode than did nonprofit agencies, regardless of region.

Patient Outcomes. The study found that home health patients in the low-use Pacific region had among the lowest rates of home health readmission, inpatient admission, and mortality during the period immediately following study episodes, while patients in the high-use East South Central region had among the highest. The observed differences in these patient outcomes for the two regions leads us to reject the hypotheses that low levels of home health care lead to poorer patient outcomes (or vice versa). The differences may just reflect the relative pre-episode health of home health patients in the regions. However, patients in the Pacific region did have the highest rates of SNF admission following home health. Because the region also had above-average use of SNFs immediately prior to home health, we conjectured that SNFs may be more widely used in this part of the country (as they also seemed to be in the West North Central and Mountain regions). SNF care is likely to be one of the alternative sources of care available to frail patients in this region.

Conclusion. We conclude that home health agencies in the East South Central region are providing appropriately higher levels of service in response to the needs of very frail and chronically ill patients who may have access to relatively few alternative sources of care and few resources to purchase those available. By contrast, agencies in the Pacific region serve a much less frail cross-section of Medicare beneficiaries who seem to have better access to alternative care. Although our ability to assess the contribution of FI practice to regional variation was limited, we did not find evidence that FI practice played a major role in the variation. Furthermore, our data suggest that the low levels of home health service delivered in the Pacific region did not lead to poorer patient outcomes among those we measured.

The inability of our data to explain more than one-third of the standard deviation of between-region mean visits per episode clearly reflects that other factors (for example, practice patterns,

service supply, and patient characteristics in addition to those we measured) contribute to the phenomenon of regional variation in home health use.

Recommendations. Characteristics of patients and areas clearly differ between the regions with the highest and lowest use of the Medicare home health benefit. We have speculated that many of the Pacific counterparts of the frail home health patients in the East South Central region may never enter home health because they are served in other settings or by other programs, and those who do enter it move to other settings or programs when their pressing skilled needs end.

We therefore recommend that future research focus on the following questions:

- Are frail beneficiaries in the Pacific region more likely than similar beneficiaries in other regions to find care in settings other than Medicare home health? If so, what are these settings, and are they more or less cost-effective than home health? Do frail Medicare home health patients in this region leave home health earlier to use other types of services for long-term care (including both home- and community-based and residential services)? If so, are such programs more or less cost-effective than home health?

- Do differences in the availability of such alternate sources of long-term care underlie the differences between the high and low home health use regions? If so, would it be cost-effective and feasible to develop alternate sources of care for beneficiaries in high-use regions like the East South Central region? Or is there some reason why these sources would not be appropriate for long-term home health patients in this region?

- If there are sources of care that are cost-effective, feasible, and appropriate alternatives to home health in high-use regions, who should fund them? If funding is to remain with the states, then what financial incentives are needed for states to increase such funding?

Because we found that the secondary data used for this study only explained one-third of the standard deviation of between-region mean visits per episode, we conclude that the patient, agency, and area characteristics we have identified do not fully explain regional variation in home health use. Thus, another focus for future research might lie with these questions:

- Do differences in home health practice patterns across regions (due to differences in staff attitudes about home health care, training, industry influences, or FI behavior) or regional differences in physician practice regarding orders for home health underlie the differences between high- and low-use regions?

- To what extent do patient characteristics such as compliance with recommended treatments, functional status, and level of informal support explain differences?

The models estimated to explore regional variation also suggested that proprietary agencies provide substantially more visits than nonprofit agencies, regardless of region. This suggestion leads to these questions:

- Why do proprietary agencies provide so many more visits per episode? Are proprietary agencies more likely to be located in areas with high proportions of frail beneficiaries? Do they employ more home health aides, filling a need for ongoing care of frail patients? Or do they simply provide more care than nonprofit agencies because it is financially advantageous?

The Medicare home health benefit has been evolving incrementally along a continuum toward long-term care in both policy and practice. In some cases, home health may be appropriate long-term care. In other cases, less costly care may exist that is at least as effective for delivering long-term care. As the need for long-term care increases in the coming decades, the importance of increasing the pool of knowledge surrounding these questions grows commensurately.

REFERENCES

Alter, JoAnne, and David Holzman. "Interest in Outcomes Research is Growing Rapidly." *Business and Health, Special Report: Putting Outcomes Research to Work*, 1992, pp. 8-13.

American Hospital Association. *Hospital Statistics: 1991-92 Edition.* Chicago, IL: American Hospital Association, 1991, Tables 5A and 5B.

Bishop, Christine, and Kathleen Skwara. "Recent Growth of Medicare Home Health." *Health Affairs*, fall 1993, pp. 95-110.

Branch, Laurence, and Henry Goldberg. "A Preliminary Case-Mix Classification System for Medicare Home Health Clients." *Medical Care*, vol. 31, no. 4, 1993, pp. 309-321.

Cordero, Cindy, and Lynne Christensen. "Practice Guidelines are Adding Value to Managed Care." *Business and Health*, August 1992, pp. 22-27.

Feder, Judith. "Paying for Home Care." In *Financing Home Care*, edited by Diane Rowlands and Barbara Lyons. Baltimore, MD: Johns Hopkins University Press, 1991.

Helbing, Charles. "Medicare Program Expenditures." *Health Care Financing Review*, 1992 Annual Supplement, 1993, pp. 23-54.

Helbing, Charles, Judith Sangl, and Herbert Silverman. "Home Health Agency Benefits." *Health Care Financing Review*, 1992 Annual Supplement, 1993, pp. 125-148.

"HHA Growth." *Home Health Line*, January 12, 1994, pp. 20-21.

Kenney, Genevieve. "Is Access to Home Health Care a Problem in Rural Areas?" *American Journal of Public Health*, vol. 83, no. 3, March 1993, pp. 412-414.

Manton, Kenneth, and Tony Hausner. "A Multidimensional Approach to Case Mix for Home Health Services." *Health Care Financing Review*, vol. 8, no. 4, summer 1987, pp. 37-54.

Phillips, Barbara, Randall Brown, Jennifer Schore, Amy Klein, Peter Schochet, Jerrold Hill, and Dexter Chu. "Case-Mix Analysis Using Demonstration Data: Home Health Prospective Payment Demonstration." Report submitted to the Health Care Financing Administration. Princeton, NJ: Mathematica Policy Research, Inc., December 1992.

Prospective Payment Assessment Commission. "American Health Care System: Report to Congress." ProPAC, June 1993.

Schore, Jennifer, Randall Brown, and Barbara Phillips. "Medicare Home Health Episodes 1990/1991: Distributions of Episode Length and Number of Visits Provided per Episode." Report submitted to the Health Care Financing Administration. Princeton, NJ: Mathematica Policy Research, Inc., January 1993.

Schore, Jennifer, and Barbara Phillips. "Evaluation of the Home Health Prospective Payment Demonstration: Summary of the Clinical Panel Meeting on Home Health Treatments." Report submitted to the Health Care Financing Administration. Princeton, NJ: Mathematica Policy Research, Inc., July 1992.

Shaughnessy, Peter, Robert Schlenker, and David Hittle. "A Study of Home Health Care Quality and Cost Under Capitated and Fee-For-Service Payment Systems." Report submitted to the Health Care Financing Administration. Denver, CO: Center for Health Policy Research, February 1994.

Smith, Mary, Rodney Baker, Laurence Branch, Robert Walls, Richard Grimes, Judith Karklins, Ann Parks, Paul Rogers, Ann Saczuk, and Marilyn Wagster-Weare. "Case-Mix Groups for VA Hospital-Based Home Care." *Medical Care*, vol. 30, no. 1, 1992, pp. 1-16.

Stone, Robyn, Robert Friedland, and Shruti Rajan. "Medicare Home Health Agencies' Use of the Management and Evaluation Benefit." Report submitted to the Health Care Financing Administration. Bethesda, MD: Project HOPE Center for Health Affairs, August 1993.

Thornton, Craig, Walter Leutz, and Barbara Phillips. "Changing Incentives in Changing Times: A Case Study of Selected Agencies Participating in the Per-Visit Prospective Payment Demonstration." Report submitted to the Health Care Financing Administration. Princeton, NJ: Mathematica Policy Research, Inc., August 1993.

U.S. Department of Health and Human Services, Health Care Financing Administration, Office of the Actuary. Unpublished figures. March 1994.

U.S. General Accounting Office. *Medicare Home Health Services: A Difficult Program to Control*. Publication no. HRD-81-55. Gaithersburg, MD: GAO, September 1981.

U.S. General Accounting Office. *Medicare: Need to Strengthen Home Health Care Payment Controls and Address Unmet Needs*. Publication no. HRD-87-9. Gaithersburg, MD: GAO, December 1986.

U.S. General Accounting Office. *Medicare: Increased Denials of Home Health Claims During 1986 and 1987*. Publication no. HRD-90-14BR. Gaithersburg, MD: GAO, January 1990.

Vladeck, Bruce. Speech to National Association for Home Care, March 14, 1994.

Welch, W. Pete, Mark Miller, Gilbert Welch, Elliot Fisher, and John Wennberg. "Geographic Variation in Expenditures for Physicians' Services in the United States." *New England Journal of Medicine*, March 4, 1993, pp. 621-627.

Wennberg, John. "Outcomes Research, Cost Containment, and the Fear of Health Care Rationing." *New England Journal of Medicine*, vol. 323, no. 17, October 25, 1990, pp. 1202-1204.

Wennberg, John, Jean Freeman, Roxanne Shelton, and Thomas Bubolz. "Hospital Use and Mortality among Medicare Beneficiaries in Boston and New Haven." *New England Journal of Medicine*, vol. 321, no. 17, October 26, 1989, pp. 1168-1173.

Wennberg, John, Albert Mulley, Daniel Hanley, Robert Timothy, Floyd Fowler, Noralou Roos, Michael Barry, Klim McPherson, E. Robert Greenberg, David Soule, Thomas Bubolz, Elliot Fisher, and David Malenka. "An Assessment of Prostatectomy for Benign Urinary Tract Obstruction: Geographic Variations and the Evaluation of Medical Outcomes." *Journal of the American Medical Association*, vol. 259, no. 20, May 27, 1988, pp. 3027-3030.

Wennberg, John. "Dealing with Medical Practice Variations: A Proposal for Action." *Health Affairs*, summer 1984, pp. 6-32.

APPENDIX A

COMPANION TABLES FOR CHAPTER III

TABLE A.1

MEAN NUMBER OF VISITS PER EPISODE AND EPISODE LENGTH BY REGION
FOR SAMPLES USED IN TABULATIONS DISCUSSED IN CHAPTER III

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Mean Number of Visits per Episode										
Episodes Starting in 1990/91/92	49	29	33	31	47	79	56	39	26	42
Episodes Starting in 1990/91	56	30	36	34	52	95	64	43	27	47
Completed Episodes Starting in 1990/91	41	27	29	28	41	58	49	35	24	36
Episodes Matching 1991 RHHI	60	33	37	34	54	86	65	49	34	48
Mean Episode Length (Days)										
Episodes Starting in 1990/91/92	83	61	82	74	83	149	103	69	55	82
Episodes Starting in 1990/91	95	66	94	83	94	180	121	77	60	94
Completed Episodes Starting in 1990/91	73	58	75	68	74	117	96	64	52	73
Episodes Matching 1991 RHHI	92	66	90	82	93	164	120	83	69	93
Number of Episodes										
Episodes Starting in 1990/91/92	44,427	106,349	95,778	38,778	130,100	52,830	64,395	24,520	77,667	634,844
Episodes Starting in 1990/91	27,798	67,409	60,355	24,244	80,636	34,850	38,556	14,943	49,731	398,522
Completed Episodes Starting in 1990/91	26,684	66,360	58,298	23,570	77,748	30,890	36,697	14,588	49,103	383,938
Episodes Matching 1991 RHHI	12,046	29,290	28,643	12,182	27,585	11,503	18,933	5,808	10,808	156,798

SOURCE: Medicare 40 Percent Home Health Bill Records files, 1990-1992.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

TABLE A.2

DEMOGRAPHIC CHARACTERISTICS AT EPISODE START BY GEOGRAPHIC REGION

Characteristic	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Female (Percentage)	65.0	64.7	63.7	64.7	64.1	66.3	65.5	64.0	63.5	64.5
Age (Percentage)										
Less than 65	4.0	3.7	4.7	4.1	5.2	6.4	5.2	4.9	4.7	4.7
65 to 74	21.6	22.6	23.7	20.6	23.4	22.3	24.0	22.6	22.4	22.8
75 to 84	41.1	43.1	41.7	42.1	41.5	40.5	41.2	41.7	41.2	41.7
85 or over	33.3	30.7	29.9	33.2	29.9	30.8	29.6	30.9	31.6	30.8
White (Percentage)	94.0	86.8	84.8	89.3	80.8	77.0	79.6	91.9	86.4	84.5
Mean Episode Length (Days)[a]	95	66	94	83	94	180	121	77	60	94
Mean Number of Visits per Episode[a]	56	30	36	34	52	95	64	43	28	47
Number of Episodes	44,427	106,349	95,778	38,778	130,100	52,830	64,395	24,520	77,667	634,844

SOURCE: Medicare 40 Percent Home Health Bill Records files for 1990-1992.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

[a] Tabulations of characteristics and the number of episodes are based on episodes that started in 1990, 1991, or 1992. Mean episode length and number of visits are based on episodes starting in 1990 or 1991 to avoid the extreme censoring of episodes that started in 1992. However, regional patterns of episode length and visits rendered are the same for both samples.

MOST PREVALENT PRINCIPAL DIAGNOSIS GROUPS AT EPISODE START BY GEOGRAPHIC REGION

Diagnostic Group (Based on Principal Diagnosis)[a] (Percentage)	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Serious Cardiopulmonary Conditions	10.1	12.8	11.8	11.0	11.5	9.6	10.3	8.6	9.1	11.0
Less Serious Neuromuscular and Skeletal Conditions	7.9	7.1	7.5	8.4	7.8	6.4	6.8	9.3	8.8	7.6
Serious Cancers	8.6	8.8	8.5	8.7	6.5	5.3	6.3	7.0	8.4	7.6
Acute or Serious Respiratory Conditions	7.7	7.5	7.4	7.9	7.4	6.1	7.0	9.9	8.5	7.5
Diabetes	5.5	5.8	7.1	6.1	7.0	11.4	9.7	5.9	4.6	7.0
Less Serious Cardiopulmonary Conditions	6.3	6.5	5.6	5.6	6.0	5.3	5.0	4.2	4.8	5.6
Stroke	4.3	5.5	5.6	5.0	5.9	5.5	5.6	4.9	6.2	5.6
Hypertension and Cerebrovascular Conditions	3.7	4.1	4.8	4.4	6.1	8.3	8.0	3.2	3.3	5.2
Mean Episode Length (Days)[b]	95	66	94	83	94	180	121	77	60	94
Mean Number of Visits per Episode[b]	56	30	36	34	52	95	64	43	28	47
Number of Episodes	44,427	106,349	95,778	38,778	130,100	52,830	64,395	24,520	77,667	634,844

SOURCE: Medicare 40 Percent Home Health Bill Records files, 1990-1992.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

[a] The classification system for principal diagnoses employed in this study groups ICD-9 codes into 1 of 46 categories, according to the type and amount of home health care to which they typically give rise. The eight most common categories are presented in this table. Serious cardiopulmonary conditions include congestive heart failure and acute myocardial infarction; less serious neuromuscular and skeletal conditions include rheumatoid arthritis, osteoarthritis, and rheumatism; acute or serious respiratory conditions include pneumonia and chronic obstructive pulmonary disorders such as chronic bronchitis and emphysema; and less serious cardiopulmonary conditions include angina and subacute and chronic ischemic heart diseases. See Exhibit A.1 for a list of all 46 categories. Percentages exclude 8,536 episodes with ICD-9 codes not currently grouped by the classification system.

[b] Tabulations of characteristics and the number of episodes are based on episodes that started in 1990, 1991, or 1992. Mean episode length and number of visits are based on episodes starting in 1990 or 1991 to avoid the extreme censoring of episodes that started in 1992. However, regional patterns of episode length and visits rendered are the same for both samples.

EXHIBIT A.1

DIAGNOSTIC CARE GROUPS

	Percentage of Episodes in Group
Administration of Antibiotics	0.8
Care Following Amputation	0.1
Care of Acute, or Serious Respiratory Diseases	7.4
Care of Serious Cardiopulmonary Conditions	10.8
Care of Less Serious Cardiopulmonary and Respiratory Conditions	5.6
Care of Serious Cancers	7.5
Care Associated with Benign Tumors and Limited Cancers	0.6
Care of Infectious, Contagious, and Parasitic Diseases	0.4
Care Following Knee Surgery	0.0
Care Following Hip Surgery	3.8
Care Following Fracture, Paralysis, or Bone or Joint Surgery of an Upper Limb	0.7
Care Following Fracture, Paralysis, or Bone or Joint Surgery of a Lower Limb	1.3
Care of the Cognitively Impaired	0.4
Care of Urinary Incontinence and Bladder Disorders	3.1
Care of a Urinary Catheter and Other Urinary Procedures	0.2
Care of Kidney Disease	0.7
Care of Bowel Incontinence	0.4
Care of Back Disorders	2.7
Care of Malnutrition, Dehydration, and Electrolyte Imbalance	1.5
Care of Anemia	1.6
Care of Peripheral Vascular Disease	1.3
Care of Gastrointestinal Disorders	3.7
Care of Disorders of the Lymph- and Blood-Forming Tissues	1.0
Care Following a Stroke	5.5
Care of Hypertension and Cerebrovascular Disease	5.1
Care of Acute Vascular Lesions and Aneurysms	1.3
Care of a Complicated Wound	4.7
Care of an Uncomplicated Wound	2.5
Care of Serious Neuromuscular and Degenerative Diseases	1.5
Care of Less Serious Neuromuscular and Skeletal Diseases	7.5
Care of Metabolic Disorders Other than Diabetes	0.2
Care of Congenital Conditions	0.2
Care of Miscellaneous Symptoms and Injuries	5.6
Diabetic Care	6.9
Eye and Ear Care	0.5

Gastrostomy Care and Enteral Feeding	0.1
Laryngectomy Care	0.0
Medication Supervision	0.3
Monitoring Following Head Injury or Head Surgery	0.2
Monitoring Following Heart Surgery	0.0
Monitoring Following Surgery on Blood Vessels	0.0
Monitoring Following Other Serious Surgery	0.1
Monitoring Following Lesser Procedures	0.2
Ostomy Care (Other than Gastrostomy and Tracheostomy)	0.1
Psychiatric Monitoring	0.8
Tracheostomy Care	0.0

NOTE: This grouping system was originally developed for HCFA's study of the Adequacy of Post-Hospital Care for the Elderly and was later used to develop a case-mix adjustor for the Home Health Prospective Payment demonstration. The system assigns patients to care categories based on both principal diagnosis and surgical procedures that give rise to home health care. However, only diagnosis was available on the 40 Percent Bill Records files.

Percentages are based on full sample of 634,844 episodes.

We combined some of these categories for our analysis because the categories contained no episodes for analyses carried out on subsamples. Categories were combined as follows:

Care of ostomies: ostomy care, laryngectomy care, gastrostomy care and enteral feeding, tracheostomy care

Care of complicated wounds or amputations: care of a complicated wound, care following amputation

Care of patients with mental difficulties: care of the cognitively impaired, medication supervision, psychiatric monitoring

Care for urinary-tract problems: care of urinary incontinence and bladder disorders, care of a urinary catheter and other urinary procedures, care of kidney disease

Care for infections and administration of antibiotics: care of infectious, contagious, and parasitic diseases; administration of antibiotics

Care following major fractures or surgery: care following fracture, paralysis, or bone or joint surgery of an upper or lower limb; monitoring following head injury or head surgery, heart surgery, other serious surgery, or lesser procedures

Care of miscellaneous problems: care of miscellaneous symptoms and injuries, care of metabolic disorders other than diabetes, care of benign tumors and limited cancers, care of bowel incontinence, care of disorders of lymph- and blood-forming tissues, care of acute vascular lesions and aneurysms, care of congenital conditions

TABLE A.4

MOST PREVALENT CO-MORBID CONDITIONS AT EPISODE START BY GEOGRAPHIC REGION

Diagnostic Groups (Based on Secondary Diagnoses)[a] (Percentage)	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Diabetes	13.2	13.3	14.7	12.3	11.0	11.4	12.1	10.3	10.5	12.2
Chronic Obstructive Pulmonary Disease	8.9	7.7	9.4	9.3	7.4	7.8	8.6	10.6	8.6	8.4
Congestive Heart Failure	7.3	7.4	9.4	8.9	6.0	8.1	7.9	8.8	7.0	7.6
Cancer	6.2	5.9	6.8	6.6	4.7	4.4	5.2	5.5	6.2	5.7
Malnutrition/ Dehydration/ Electrolyte Imbalance	4.2	4.0	6.3	6.1	4.9	6.8	6.0	5.3	4.7	5.2
Incontinence	0.7	0.7	1.6	1.1	2.3	6.5	3.2	1.7	2.1	2.1
Mean Episode Length (Days)[b]	95	66	94	83	94	180	121	77	60	94
Mean Number of Visits per Episode[b]	56	30	36	34	52	95	64	43	28	47
Number of Episodes	44,427	106,349	95,778	38,778	130,100	52,830	64,395	24,520	77,667	634,844

SOURCE: Medicare 40 Percent Home Health Bill Records files, 1990-1992.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

[a] The classification system for secondary diagnoses employed in this study groups ICD-9 codes into 16 categories denoting co-morbid conditions that are believed to prolong recovery and thus may increase home health resource use. The six most common co-morbidities are presented in this table. See Exhibit A.2 for a list of all 16 conditions.

[b] Tabulations of characteristics and the number of episodes are based on episodes that started in 1990, 1991, or 1992. Mean episode length and number of visits are based on episodes starting in 1990 or 1991 to avoid the extreme censoring of episodes that started in 1992. However, regional patterns of episode length and visits rendered are the same for both samples.

88

CO-MORBID CONDITIONS

	Percentage of Episodes with Condition
Amputation of a Limb	0.2
Cancer	5.7
Congestive Heart Failure	7.6
Chronic Obstructive Pulmonary Disease	8.4
Dementia	2.3
Depression	2.0
Diabetes	12.2
End-Stage Renal Disease and Chronic Renal Failure	0.6
Immune System Diseases	0.0
Incontinence	2.1
Malnutrition, Dehydration, and Electrolyte Imbalance	5.2
Neurological Diseases	4.0
Obesity	0.0
Paralysis	1.7
Peripheral Vascular Disease	3.8
Diabetes, Incontinence, Malnutrition, or Peripheral Vascular Disease in a Patient Receiving Wound Care	2.6

NOTE: The groupings of co-morbid conditions are based on the secondary diagnoses; up to four secondary diagnoses may be listed on a claim. While a primary diagnosis is required on the claim, inclusion of a secondary diagnosis can be viewed as somewhat discretionary for the agency. In fact, the notation of secondary diagnoses on claims varies substantially by region. Between one-fifth and one-quarter of episodes from the South Atlantic and Pacific states had only a primary diagnosis, compared with one-tenth of episodes from the East South Central states. Roughly two-fifths of episodes from the East and West North Central states had three or more secondary diagnoses listed, compared with one-third overall.

Percentages are based on full sample of 634,844 episodes.

MEDICARE PART A SERVICE USE AND REIMBURSEMENT PRIOR TO EPISODE START BY GEOGRAPHIC REGION

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Inpatient Services										
Discharge During the 2 Weeks Prior to Home Health Episode Start (Percentage)	57.8	68.3	59.7	56.0	53.6	43.7	48.8	53.3	53.6	**56.1**
Number of Days During 6 Months Prior to Episode	12.7	16.9	12.7	11.1	11.1	10.1	10.7	9.7	9.4	**12.0**
Medicare Reimbursement During 6 Months Prior to Episode (Dollars)	7,379	8,297	7,310	6,160	6,108	4,659	5,659	6,351	7,801	**6,798**
Skilled Nursing Facility (SNF) Services										
Discharge During the 2 Weeks Prior to Home Health Episode Start (Percentage)	5.8	5.5	6.4	11.5	5.3	4.7	7.1	12.9	11.6	**7.1**
Number of Days During 6 Months Prior to Episode	2.1	2.2	2.6	3.2	2.0	1.7	2.1	3.8	3.5	**2.4**
Medicare Reimbursement During 6 Months Prior to Episode (Dollars)	447	557	410	593	422	366	711	940	821	**548**
Home Health Services										
Number of Visits During 6 Months Prior to Episode Start	6.0	4.3	4.2	3.8	7.2	9.1	7.6	4.9	4.1	**5.7**
Medicare Reimbursement During 6 Months Prior to Episode (Dollars)	301	265	243	203	364	406	388	288	316	**312**
Mean Episode Length (Days)[a]	95	66	94	83	94	180	121	77	60	**94**
Mean Number of Visits per Episode[a]	56	30	36	34	52	95	64	43	28	**47**
Number of Episodes	44,427	106,349	95,778	38,778	130,100	52,830	64,395	24,520	77,667	**634,844**

TABLE A.5 (continued)

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

[a]Tabulations of characteristics and the number of episodes are based on episodes that started in 1990, 1991, or 1992. Mean episode length and number of visits are based on episodes starting in 1990 or 1991 to avoid the extreme censoring of episodes that started in 1992. However, regional patterns of episode length and visits rendered are the same for both samples.

TABLE A.6

DISTRIBUTION OF EPISODES BY AGENCY TYPE AND CONTROL FOR EACH GEOGRAPHIC REGION

Characteristic	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Type of Agency										
VNA	77.3	41.2	23.9	10.9	8.1	2.8	6.9	12.4	23.8	22.6
Hospital-Based	7.6	30.7	25.1	45.1	23.2	22.6	34.0	37.2	38.3	28.4
SNF- or Rehab-Based	0.4	1.2	0.4	4.0	0.3	0.9	0.1	0.7	1.2	0.8
Government/Voluntary	0.2	0.7	1.4	0.9	0.1	0.2	0.2	0.0	0.8	0.6
Other (Proprietary, Private Nonprofit, Official Government)	14.2	26.0	48.5	38.5	67.2	73.1	56.6	48.2	35.0	46.8
Type of Agency Missing	0.2	0.2	0.8	0.7	1.1	0.4	2.3	1.4	0.9	0.9
Type of Control										
Nonprofit	87.4	80.5	65.1	63.6	40.8	32.1	36.5	50.9	57.0	57.0
Proprietary	9.6	10.6	23.3	17.1	47.9	49.9	51.1	33.9	29.2	31.1
Government	2.9	8.8	11.2	19.2	11.0	18.0	12.0	15.0	13.3	11.7
Type of Control Missing	0.1	0.0	0.3	0.1	0.3	0.1	0.3	0.2	0.4	0.2
Mean Episode Length (Days)[a]	95	66	94	83	94	180	121	77	60	94
Mean Number of Visits per Episode[a]	56	30	36	34	52	95	64	43	28	47
Number of Episodes	44,427	106,349	95,778	38,778	130,100	52,830	64,395	24,520	77,667	634,844

SOURCE: Medicare Provider of Services files, 1990-1992.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

[a]Tabulations of characteristics and the number of episodes are based on episodes that started in 1990, 1991, or 1992. Mean episode length and number of visits are based on episodes starting in 1990 or 1991 to avoid the extreme censoring of episodes that started in 1992. However, regional patterns of episode length and visits rendered are the same for both samples.

TABLE A.7

DISTRIBUTION OF EPISODES BY OTHER AGENCY CHARACTERISTICS FOR EACH GEOGRAPHIC REGION

Characteristic	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Program Participation										
Medicare and Medicaid	70.2	98.7	94.6	97.0	75.2	96.0	90.3	72.5	87.4	87.7
Medicare only	28.7	1.2	4.8	2.9	22.3	3.8	9.3	26.9	10.3	11.2
Program participation missing	1.1	0.1	0.6	0.1	2.5	0.2	0.4	0.6	2.3	1.1
Number of Years Medicare Certified at Episode Start	20.9	18.3	13.5	12.5	12.4	12.2	8.8	10.6	12.9	13.7
Mean Episode Length (Days)[a]	95	66	94	83	94	180	121	77	60	94
Mean Number of Visits per Episode[a]	56	30	36	34	52	95	64	43	28	47
Number of Episodes	44,427	106,349	95,778	38,778	130,100	52,830	64,395	24,520	77,667	634,844

SOURCE: Medicare Provider of Services files, 1990-1992.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

[a] Tabulations of characteristics and the number of episodes are based on episodes that started in 1990, 1991, or 1992. Mean episode length and number of visits are based on episodes starting in 1990 or 1991 to avoid the extreme censoring of episodes that started in 1992. However, regional patterns of episode length and visits rendered are the same for both samples.

DISTRIBUTION OF EPISODES BY FISCAL INTERMEDIARY FOR EACH GEOGRAPHIC REGION
(Percentage)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Maine (Blue Cross)	**96.4**	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	**6.8**
Philadelphia (Independence Blue Cross, Aetna Ft. Washington)	0.0	**44.4**	0.1	0.0	21.9	0.1	0.0	0.1	0.0	**12.0**
South Carolina (Blue Cross)	0.9	0.1	1.7	0.0	18.6	**55.3**	2.0	1.1	3.9	**9.5**
Florida (Aetna Clearwater)	0.3	0.7	1.2	0.1	**48.9**	40.7	1.1	0.9	1.9	**14.1**
Wisconsin (Blue Cross)	1.3	**53.0**	35.3	16.6	5.4	1.6	1.2	1.8	1.1	**16.9**
Illinois (Health Care Service Corp.)	0.3	0.1	**56.7**	0.1	0.2	0.3	0.2	2.2	0.1	**8.8**
New Mexico (Blue Cross)	0.0	0.0	0.1	0.6	0.0	0.1	**82.7**	9.7	0.1	**8.8**
Iowa (Blue Cross Iowa/ South Dakota)	0.9	1.7	4.9	**82.0**	4.9	1.9	12.9	**52.0**	7.8	**11.5**
California (Blue Cross)	0.0	0.0	0.1	0.6	0.1	0.0	0.1	32.2	**85.1**	**11.7**
Mean Episode Length (Days)[a]	95	66	94	83	94	180	121	77	60	**94**
Mean Number of Visits per Episode[a]	56	30	36	34	52	95	64	43	28	**47**
Number of Episodes	44,427	106,349	95,778	38,778	130,100	52,830	64,395	24,520	77,667	634,844

SOURCE: Medicare 40 Percent Home Health Bill Records files, 1990-1992.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Numbers in boldface indicate major fiscal intermediaries for the region.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

[a] Tabulations of characteristics and the number of episodes are based on episodes that started in 1990, 1991, or 1992. Mean episode length and number of visits are based on episodes starting in 1990 or 1991 to avoid the extreme censoring of episodes that started in 1992. However, regional patterns of episode length and visits rendered are the same for both samples.

DISTRIBUTION OF EPISODES BY URBAN/RURAL CLASSIFICATION OF AGENCY FOR EACH GEOGRAPHIC REGION

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Type of County in Which Agency Located[a]										
Large metropolitan core county	24.2	34.6	32.9	15.6	24.5	0.0	22.2	22.0	51.6	27.8
Large metropolitan fringe county	16.8	27.2	16.5	18.7	14.1	0.9	6.4	5.8	14.9	15.0
Medium metropolitan county	34.0	25.9	16.8	9.2	23.2	43.7	21.6	25.8	15.1	23.3
Lesser metropolitan county	8.0	1.8	10.3	15.1	11.8	7.2	16.9	11.2	6.7	9.3
Urbanized nonmetropolitan county	9.8	5.2	8.2	9.4	9.1	16.1	9.5	20.8	7.4	9.2
Less urbanized nonmetropolitan county	6.3	5.1	13.3	27.1	13.0	28.1	21.5	13.4	3.6	13.1
Thinly populated	1.0	0.2	2.1	4.9	3.1	4.0	1.9	1.1	0.5	2.0
Urban/rural code missing	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.3	0.3
Mean Episode Length (Days)[b]	95	66	94	83	94	180	121	77	60	94
Mean Number of Visits per Episode[b]	56	30	36	34	52	95	64	43	28	47
Number of Episodes	44,427	106,349	95,778	38,778	130,100	52,830	64,395	24,520	77,667	634,844

SOURCE: 1993 Area Resource File (ARF).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing. ARF data were merged to episodes according to the county in which the home health agency providing the episode was located. If ARF data were available for more than one year, data were merged for the year when the episode began.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

[a] 1988 Rural/Urban Continuum Code for Metro and Nonmetro Counties developed by the Department of Agriculture.

[b] Tabulations of characteristics and the number of episodes are based on episodes that started in 1990, 1991, or 1992. Mean episode length and number of visits are based on episodes starting in 1990 or 1991 to avoid the extreme censoring of episodes that started in 1992. However, regional patterns of episode length and visits rendered are the same for both samples.

TABLE A.10

COUNTY-LEVEL PROFESSIONAL STAFF SUPPLY FOR AGENCY COUNTIES FOR EACH GEOGRAPHIC REGION

Number of Professionals per 10,000 Persons	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Physicians (1992)	26.8	27.3	19.2	17.2	20.7	18.6	16.5	20.3	21.5	21.3
Registered Nurses[a] (1991)	31.5	41.2	33.8	31.1	35.3	39.4	29.8	31.7	24.1	33.8
Licensed Practical Nurses[a] (1991)	4.6	7.3	5.9	6.7	8.1	13.6	12.2	5.1	4.4	7.6
Physical Therapists[b] (1991)	1.0	0.8	0.8	0.9	0.7	0.8	0.6	0.9	0.6	0.8
Occupational Therapists[a] (1991)	0.8	0.6	0.6	0.5	0.5	0.4	0.4	0.7	0.4	0.5
Speech Pathologists[a] (1991)	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.1	0.2
Mean Episode Length (Days)[c]	95	66	94	83	94	180	121	77	60	94
Mean Number of Visits per Episode[c]	56	30	36	34	52	95	64	43	28	47
Number of Episodes	44,427	106,349	95,778	38,778	130,100	52,830	64,395	24,520	77,667	634,844

SOURCE: 1993 Area Resource File (ARF).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing. ARF data were merged to episodes according to the county in which the home health agency providing the episode was located. If ARF data were available for more than one year, data were merged for the year when the episode began.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

[a] Full-time, hospital-based personnel in short-term general, short-term nongeneral, and long-term hospitals

[b] Full-time, hospital-based physical therapists in short-term general hospitals

[c] Tabulations of characteristics and the number of episodes are based on episodes that started in 1990, 1991, or 1992. Mean episode length and number of visits are based on episodes starting in 1990 or 1991 to avoid the extreme censoring of episodes that started in 1992. However, regional patterns of episode length and visits rendered are the same for both samples.

HOSPITAL, NURSING HOME, AND HOME HEALTH AGENCY SUPPLY FOR AGENCY COUNTIES FOR EACH GEOGRAPHIC REGION

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Hospital Occupancy Rate (Percentage) (1990, 1991)	71	76	59	55	61	57	51	57	56	61
Hospital Beds per 1,000 Persons 65 or Older (1990, 1991)	39.2	41.8	40.9	45.8	37.7	52.7	49.3	38.9	32.7	41.3
Mean Hospital Length of Stay (1991) (Days)[a]	7.2	8.6	7.3	8.4	7.1	7.1	6.4	6.5	6.2	7.3
Skilled Medicare Nursing Home Beds per 1,000 Beneficiaries (1986)	16.4	19.9	15.2	8.5	10.0	9.4	4.0	7.5	15.5	12.7
Proportion of Hospitals (1991) with:										
Geriatric acute care units	.19	.12	.16	.15	.09	.08	.07	.11	.08	.11
Geriatric assessment programs	.37	.32	.29	.33	.17	.12	.11	.25	.19	.23
Geriatric clinics	.16	.19	.16	.10	.06	.04	.04	.14	.07	.11
Home health agencies	.21	.38	.37	.59	.30	.36	.40	.45	.35	.36
Medicare Home Health Agencies per 10,000 Beneficiaries (1990, 1991, 1992)[b]	2.8	1.5	2.7	4.8	2.4	5.2	7.1	4.5	2.3	3.3
Mean Episode Length (Days)[c]	95	66	94	83	94	180	121	77	60	94
Mean Number of Visits per Episode[c]	56	30	36	34	52	95	64	43	28	47
Number of Episodes	44,427	106,349	95,778	38,778	130,100	52,830	64,395	24,520	77,667	634,844

SOURCE: 1993 Area Resource File (ARF).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing. ARF data were merged to episodes according to the county in which the home health agency providing the episode was located. If ARF data were available for more than one year, data were merged for the year when the episode began.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

[a] Hospital length of stay was approximated by dividing number of short-term, general hospital days by number of discharges.

[b] Number of Medicare home health agencies in a county was computed from Medicare Provider of Service files.

[c] Tabulations of characteristics and the number of episodes are based on episodes that started in 1990, 1991, or 1992. Mean episode length and number of visits are based on episodes starting in 1990 or 1991 to avoid the extreme censoring of episodes that started in 1992. However, regional patterns of episode length and visits rendered are the same for both samples.

PER CAPITA INCOME, PERCENT ELDERLY LIVING IN POVERTY, AND MEDICARE EXPENDITURES FOR AGENCY COUNTIES FOR EACH GEOGRAPHIC REGION

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Per Capita Income (Thousands of Dollars) (1990)	22.3	21.7	18.4	18.0	18.4	15.1	15.7	16.7	20.2	18.8
Percent of Elderly Living in Poverty (1989)	9.1	10.3	10.0	11.2	13.7	21.4	18.6	10.5	7.6	12.4
Mean Annual Medicare Reimbursement per Beneficiary (1990) (Thousands of Dollars)	3.2	3.6	3.2	2.7	3.0	2.9	3.2	2.6	2.9	3.1
Mean Episode Length (Days)[a]	95	66	94	83	94	180	121	77	60	94
Mean Number of Visits per Episode[a]	56	30	36	34	52	95	64	43	28	47
Number of Episodes	44,427	106,349	95,778	38,778	130,100	52,830	64,395	24,520	277,667	634,844

SOURCE: 1993 Area Resource File (ARF).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing. ARF data were merged to episodes according to the county in which the home health agency providing the episode was located. If ARF data were available for more than one year, data were merged for the year when the episode began.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

[a]Tabulations of characteristics and the number of episodes are based on episodes that started in 1990, 1991, or 1992. Mean episode length and number of visits are based on episodes starting in 1990 or 1991 to avoid the extreme censoring of episodes that started in 1992. However, regional patterns of episode length and visits rendered are the same for both samples.

FUNCTIONAL LIMITATIONS AND ACTIVITIES PERMITTED AT EPISODE START BY GEOGRAPHIC REGION
(Percentage)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Most Frequently Noted Functional Limitations										
Endurance	87.9	90.4	91.3	90.3	91.4	90.1	91.8	90.2	88.6	90.6
Ambulation	72.2	76.9	75.3	73.0	83.3	81.0	81.6	76.3	76.8	77.9
Dyspnea with Minimal Exertion	30.0	30.1	24.2	34.0	37.3	45.8	13.7	29.6	30.5	29.8
Hearing	20.3	17.6	21.9	22.4	18.5	26.5	23.9	22.5	17.0	20.7
Bowel or Bladder Incontinence	12.9	13.0	16.7	14.4	16.1	21.9	20.0	17.1	16.9	16.2
Most Frequently Noted Activities Permitted										
Up as Tolerated	78.0	73.6	48.0	76.9	69.3	65.2	31.1	67.7	66.5	62.3
Transfer from Bed to Chair	12.3	18.6	34.1	12.5	19.8	21.2	15.7	17.9	20.7	20.6
Bed Rest with Bathroom Privileges	2.2	3.0	2.9	3.3	3.8	4.6	56.6	13.8	7.4	10.4
Use of Equipment Noted										
Walker	32.7	32.6	27.8	35.3	32.7	32.0	8.1	34.0	36.2	29.3
Cane	18.9	16.7	11.6	19.4	15.3	17.2	16.8	14.8	14.2	15.7
Wheelchair	9.3	10.5	16.3	13.5	14.1	13.6	30.0	17.9	16.9	15.6
Crutches	3.0	1.4	2.0	1.5	1.1	1.3	12.3	3.6	1.8	3.0
Mean Episode Length (Days)	92	66	90	82	93	164	120	83	69	93
Mean Number of Visits per Episode	60	33	37	34	54	86	65	49	34	48
Number of Episodes	12,046	29,290	28,643	12,182	27,585	11,503	18,933	5,808	10,808	156,798

SOURCE: Medicare Regional Home Health Intermediary Database, 1991.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

See Exhibit A.3 for a full list of limitations and permitted activities used on HCFA 485 form.

EXHIBIT A.3

FUNCTIONAL LIMITATIONS AND PERMITTED ACTIVITIES
FROM THE HCFA 485 FORM

Functional Limitations	Permitted Activities
1. Amputation	1. Complete Bed Rest
2. Bowel/Bladder Incontinence	2. Bed Rest BRP (Bathroom Privileges)
3. Contracture	3. Up as Tolerated
4. Hearing	4. Transfer Bed/Chair
5. Paralysis	5. Exercises Prescribed
6. Endurance	6. Partial Weight Bearing
7. Ambulation	7. Independent at Home
8. Speech	8. Crutches
9. Legally Blind	9. Cane
A. Dyspnea (Shortness of Breath) with Minimal Exertion	A. Wheelchair
B. Other	B. Walker
	C. No Restriction
	D. Other

MOST COMMON PLANNED SKILLED NURSING TREATMENTS AT EPISODE START BY GEOGRAPHIC REGION
(Percentage)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Skilled Observation	88.1	93.4	92.5	91.6	88.9	90.8	92.7	90.5	86.7	91.1
Other Care	41.7	52.2	54.2	56.9	62.0	65.3	62.9	52.2	64.2	56.9
Other Teaching and Training	27.9	28.1	24.0	17.7	31.1	25.3	35.6	26.9	25.3	27.5
Restorative Nursing	24.3	33.5	38.4	15.0	20.8	12.5	32.4	23.7	23.7	27.3
Venipuncture	9.9	16.0	24.6	21.6	21.0	50.4	39.8	25.0	11.0	23.8
Management and Evaluation of Care Plan	17.1	16.1	16.9	9.1	11.5	7.2	17.8	16.9	11.2	14.2
Teaching Diabetic Care	9.7	12.6	12.9	10.2	11.8	11.6	14.5	10.6	11.5	12.1
Open Wound Care/ Dressing	12.1	11.3	10.4	9.3	10.9	9.7	9.9	10.6	10.6	10.6
Mean Episode Length (Days)	92	66	90	82	93	164	120	83	69	93
Mean Number of Visits per Episode	60	33	37	34	54	86	65	49	34	48
Number of Episodes	12,046	29,290	28,643	12,182	27,585	11,503	18,933	5,808	10,808	156,798

SOURCE: Medicare Regional Home Health Intermediary Database, 1991.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

See Exhibit A.4 for a full list of Medicare skilled nursing treatments.

TABLE A.15

MOST COMMON PLANNED THERAPY TREATMENTS AT EPISODE START BY GEOGRAPHIC REGION
(Percentage)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Physical Therapy										
Evaluation	27.0	31.0	22.7	19.0	28.8	21.7	20.4	33.9	37.9	26.5
Therapeutic Exercise	22.4	27.8	19.4	17.0	26.2	18.3	17.4	29.6	32.0	23.2
Gait Training	22.4	26.1	17.6	15.6	24.8	15.7	15.7	27.0	31.2	21.6
Home Program	19.1	24.1	16.2	12.4	23.0	12.0	14.6	25.4	27.8	19.4
Transfer Training	18.8	23.4	14.5	11.5	21.4	12.2	13.6	22.5	28.5	18.5
Occupational Therapy										
Evaluation	4.0	6.1	5.6	3.4	3.3	1.6	2.8	9.5	11.3	4.9
Independent Living	3.3	5.1	4.8	2.7	2.6	1.0	2.2	7.1	9.3	4.0
Muscle Re-Education	1.6	2.7	3.1	1.3	1.6	0.6	1.3	3.0	4.0	2.2
Speech Therapy										
Evaluation	1.0	2.2	2.0	0.9	1.9	1.8	1.3	2.5	2.4	1.8
Mean Episode Length (Days)	92	66	90	82	93	164	120	83	69	93
Mean Number of Visits per Episode	60	33	37	34	54	86	65	49	34	48
Number of Episodes	12,046	29,290	28,643	12,182	27,585	11,503	18,933	5,808	10,808	156,798

SOURCE: Medicare Regional Intermediary Home Health Database, 1991.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

See Exhibit A.4 for a full list of Medicare therapy treatments.

EXHIBIT A.4

MEDICARE HOME HEALTH TREATMENTS AND SERVICES

Skilled Nursing

A1 Skilled Observation
A2 Foley Insertion
A3 Bladder Instillation
A4 Open Wound Care/Dressing
A5 Decubitus Care--Stage 3, 4, 5
A6 Venipuncture
A7 Restorative Nursing
A8 Postcataract Care
A9 Bowel/Bladder Training
A10 Chest Physio (Inc/Postural Drainage)
A11 Administration of Vitamin B/12
A12 Administration of Insulin
A13 Administration of Other IM/Subcutaneous
A14 Administration of IVs/Clysis
A15 Teach Ostomy or Ileo Conduit Care
A16 Teach Nasogastric Feeding
A17 Reinsertion Nasogastric Feeding Tube
A18 Teach Gastrostomy Feeding
A19 Teach Parenteral Nutrition
A20 Teach Care of Tracheostomy
A21 Administer Care of Tracheostomy
A22 Teach Inhalation Therapy
A23 Administer Inhalation Therapy
A24 Teach Administration of Injection
A25 Teach Diabetic Care
A26 Disimpaction/F.U. Enema
A27 Other (Spec. under Orders)
A28 Wound Care/Dressing--Closed Incision/Suture Line
A29 Decubitus Care--Stage 1, 2
A30 Teach Care of Any Indwelling Catheter
A31 Management and Evaluation of Patient Care Plan
A32 Teaching and Training (Other)

Physical Therapy

B1 Evaluation
B2 Therapeutic Exercise
B3 Transfer Training
B4 Home Program
B5 Gait Training
B6 Chest Physiotherapy
B7 Ultrasound
B8 Electrotherapy
B9 Prosthetic Training
B10 Fabrication Temp Service
B11 Muscle Re-Education
B12 Management and Evaluation of Patient Care Plan
B15 Other (Specify under Orders)

Speech Therapy

C1 Evaluation
C2 Voice Disorder Treatments
C3 Speech Articulation Disorders Treatments
C4 Dysphagia Treatments
C5 Language Disorders Treatments
C6 Aural Rehabilitation
C8 Non-Oral Communication
C9 Other (Specify under Orders)

Occupational Therapy

D1 Evaluation
D2 Independent Living/Daily Living Skills
    (ADL Training)
D3 Muscle Re-Education
D5 Perceptual Motor Training
D6 Fine Motor Coordination

D7 Neuro-Developmental Treatment
D8 Sensory Treatment
D9 Orthotics/Splinting
D10 Adaptive Equipment (Fabrication and Training)
D11 Other (Specify under Orders)

Medical Social Services

E1 Assessment of Social and Emotional Factors
E2 Counseling for Long-Range Planning and
    Decision Making
E3 Community Resource Planning

E4 Short-Term Therapy
E6 Other (Specify under Orders)

Home Health Aide

F1 Tub/Shower Bath
F2 Partial/Complete Bed Bath
F4 Personal Care
F6 Catheter Care
F8 Assist with Ambulation
F10 Exercises

F11 Prepare Meal
F12 Grocery Shop
F13 Wash Clothes
F14 Housekeeping
F15 Other (Specify under Orders)

TABLE A.16

MOST COMMON PLANNED MEDICAL SOCIAL SERVICES AT EPISODE START BY GEOGRAPHIC REGION
(Percentage)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Assessment of Social and Emotional Factors	4.1	8.2	9.4	6.0	13.7	8.6	8.9	14.0	27.1	10.5
Community Resource Planning	2.5	6.8	8.4	5.5	11.8	5.6	7.9	11.6	23.5	8.9
Counseling for Long-Range Planning and Decision Making	2.9	6.8	7.3	4.4	10.7	3.8	7.1	9.5	21.2	8.0
Short-Term Therapy	1.5	2.0	2.6	1.1	3.7	1.2	2.1	3.8	8.8	2.8
Mean Episode Length (Days)	92	66	90	82	93	164	120	83	69	93
Mean Number of Visits per Episode	60	33	37	34	54	86	65	49	34	48
Number of Episodes	12,046	29,290	28,643	12,182	27,585	11,503	18,933	5,808	610,808	156,798

SOURCE: Medicare Regional Intermediary Home Health Database, 1991.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

See Exhibit A.4 for a full list of Medicare medical social services.

MOST COMMON PLANNED HOME HEALTH AIDE SERVICES AT EPISODE START BY GEOGRAPHIC REGION
(Percentage)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Personal Care	35.7	35.5	31.0	33.3	40.0	41.0	39.2	40.4	31.9	36.1
Partial/Complete Bed Bath	24.2	27.1	21.2	18.6	27.6	30.2	24.9	18.0	19.7	24.3
Assist with Ambulation	25.0	25.3	18.1	15.7	27.6	22.8	26.4	25.5	14.9	22.9
Aid with Tub/Shower Bath	20.2	12.7	15.6	22.4	22.4	18.9	27.8	32.9	21.9	19.9
Other	10.0	9.0	14.0	14.5	23.3	27.7	24.1	18.4	15.3	16.9
Housekeeping	17.2	19.8	8.0	9.8	16.1	11.8	19.5	18.0	10.8	14.7
Prepare Meal	21.6	20.7	5.6	4.3	7.7	3.8	9.0	8.9	3.3	10.2
Mean Episode Length (Days)	92	66	90	82	93	164	120	83	69	93
Mean Number of Visits per Episode	60	33	37	34	54	86	65	49	34	48
Number of Episodes	12,046	29,290	28,643	12,182	27,585	11,503	18,933	5,808	10,808	156,798

SOURCE: Medicare Regional Intermediary Home Health Database, 1991.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded columns indicate those regions with the highest per-episode home health use (East and West South Central) and the lowest home health use (Middle Atlantic and Pacific).

See Exhibit A.4 for a full list of Medicare home health aide services.

APPENDIX B

COMPANION TABLES FOR CHAPTER IV

TABLE B.1

MEAN EPISODE LENGTH AND NUMBER OF VISITS PER EPISODE BY REGION FOR 5-PERCENT SAMPLE USED IN THE MULTIVARIATE MODELS OF HOME HEALTH USE IN CHAPTER IV AND FULL SAMPLE

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Mean Number of Visits per Episode										
All Episodes Starting in 1990/91	56	30	36	34	52	95	64	43	27	47
5-Percent Random Sample of Episodes Starting in 1990/91	52	32	38	33	53	95	62	45	27	47
Mean Episode Length (Days)										
All Episodes Starting in 1990/91	95	66	94	83	94	180	121	77	60	94
5-Percent Random Sample of Episodes Starting in 1990/91	97	67	94	82	94	186	119	79	59	95
Number of Episodes										
All Episodes Starting in 1990/91	27,798	67,409	60,355	24,244	80,636	34,850	38,556	14,943	49,731	398,522
5-Percent Random Sample of Episodes Starting in 1990/91	1,427	3,369	2,975	1,200	3,868	1,731	1,919	783	2,492	19,764

SOURCE: Medicare 40 Percent Home Health Bill Records (1990-1992).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

DISTRIBUTION OF EPISODES BY FISCAL INTERMEDIARY FOR EACH GEOGRAPHIC REGION
(Percentage)
(Episodes Starting in 1990 or 1991)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Maine (Blue Cross)	96.5	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	6.8
Philadelphia (Independence Blue Cross, Aetna Ft. Washington)	0.0	45.1	0.1	0.0	22.0	0.1	0.0	0.1	0.0	12.1
South Carolina (Blue Cross)	0.7	0.1	1.5	0.0	18.8	56.1	0.2	1.3	3.3	9.6
Florida (Aetna Clearwater)	0.3	0.7	1.2	0.1	47.8	39.9	1.1	0.9	2.0	13.9
Wisconsin (Blue Cross)	1.3	52.3	35.0	16.4	5.9	1.5	1.3	2.0	1.1	16.9
Illinois (Health Care Service Corp.)	0.1	0.1	57.1	0.2	0.2	0.4	0.2	1.9	0.1	8.8
New Mexico (Blue Cross)	0.0	0.0	0.1	0.6	0.0	0.1	81.3	9.8	0.1	8.3
Iowa (Blue Cross Iowa. South Dakota)	0.9	1.6	4.9	82.0	5.1	1.9	14.1	51.8	7.6	11.5
California (Blue Cross)	0.1	0.0	0.1	0.7	0.1	0.0	0.1	32.3	85.8	12.0
Number of Episodes	27,798	67,409	60,355	24,244	80,636	34,850	38,556	14,943	49,731	398,522

SOURCE: Medicare 40 Percent Home Health Bill Records files, 1990-1992.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded cells indicate major fiscal intermediaries for each region.

TABLE B.3

MEAN NUMBER OF VISITS PER EPISODE BY FISCAL INTERMEDIARY AND GEOGRAPHIC REGION
(Episodes Starting in 1990 or 1991)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Maine (Blue Cross)	55	30	14	23	60	53	97	31	9	55
Philadelphia (Independence Blue Cross, Aetna Ft. Washington)	69	31	84	107	34	73	54	38	24	32
South Carolina (Blue Cross)	71	32	60	16	50	87	93	41	34	69
Florida (Aetna Clearwater)	53	94	39	61	60	104	84	41	42	71
Wisconsin (Blue Cross)	65	28	30	29	48	84	64	51	29	31
Illinois (Health Care Service Corp.)	151	67	38	54	41	71	57	72	52	38
New Mexico (Blue Cross)	81	25	44	37	62	84	60	29	45	59
Iowa (Blue Cross Iowa, South Dakota)	79	51	50	34	57	136	81	49	36	48
California (Blue Cross)	27	27	47	36	53	128	48	34	26	27
Mean Number of Visits per Episode	56	30	36	34	52	95	64	43	28	47
Number of Episodes	27,798	67,409	60,355	24,244	80,636	34,850	38,556	14,943	49,731	398,522

SOURCE: Medicare 40 Percent Home Health Bill Records files, 1990-1992.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded cells indicate major fiscal intermediaries for each region.

MEAN EPISODE LENGTH IN DAYS BY FISCAL INTERMEDIARY AND GEOGRAPHIC REGION
(Episodes Starting in 1990 or 1991)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Maine (Blue Cross)	95	62	37	44	79	117	120	56	36	95
Philadelphia (Independence Blue Cross, Aetna Ft. Washington)	114	77	173	157	83	203	137	75	61	79
South Carolina (Blue Cross)	147	81	115	36	122	167	150	70	74	143
Florida (Aetna Clearwater)	97	136	75	83	93	201	156	72	73	121
Wisconsin (Blue Cross)	96	56	68	66	72	120	100	76	62	63
Illinois (Health Care Service Corp.)	169	112	108	117	76	169	82	92	103	108
New Mexico (Blue Cross)	266	82	118	101	106	128	120	71	79	118
Iowa (Blue Cross Iowa, South Dakota)	100	80	110	87	76	195	124	84	65	91
California (Blue Cross)	61	60	109	85	73	148	93	67	58	59
Mean Episode Length	95	66	94	83	94	180	121	77	60	94
Number of Episodes	27,798	67,409	60,355	24,244	80,636	34,850	38,556	14,943	49,731	398,522

SOURCE: Medicare 40 Percent Home Health Bill Records files, 1990-1992.

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Shaded cells indicate major fiscal intermediaries for each region.

TABLE B5A
ESTIMATED COEFFICIENTS FOR TOBIT, NUMBER OF VISITS PER EPISODE

VARIABLE	ESTIMATED COEFFICIENT	PROBABILITY COEFFICIENT NOT EQUAL ZERO
GEOGRAPHIC REGION BINARY-NEW ENGLAND	11.64	0.0025
GEOGRAPHIC REGION BINARY-MID ATLANTIC	-11.38	0.0002
GEOGRAPHIC REGION BINARY-EAST NO CENTRAL	-7.69	0.0088
GEOGRAPHIC REGION BINARY-WEST NO CENTRAL	-9.91	0.0085
GEOGRAPHIC REGION BINARY-EAST SO CENTRAL	28.89	0.0001
GEOGRAPHIC REGION BINARY-WEST SO CENTRAL	5.02	0.1370
GEOGRAPHIC REGION BINARY-MOUNTAIN	-1.05	0.8060
GEOGRAPHIC REGION BINARY-PACIFIC	-12.71	0.0001
(GEOGRAPHIC REGION BINARY-SOUTH ATLANTIC)	OMITTED CATEGORY	
EPISODE STARTED IN YEAR 1990 - BINARY	-3.33	0.0217

PATIENT CHARACTERISTICS:

SEX BINARY- 1=FEMALE 0=OTHERWISE	1.98	0.1940
RACE BINARY - 1=WHITE 0=OTHERWISE	-6.19	0.0030
AGE BINARY - AGE 0 TO 64	-1.35	0.7249
AGE BINARY - AGE 75 TO 84	-2.71	0.1613
AGE BINARY - AGE GE 85	0.88	0.6725
(AGE BINARY - AGE 65 TO 74)	OMITTED CATEGORY	
DEMENTIA COMORBIDITY FLAG	8.11	0.0897
CANCER COMORBIDITY FLAG	-4.75	0.1418
CHF COMORBIDITY FLAG	2.98	0.2757
DIABETES COMORBIDITY FLAG	3.58	0.1161
NEUROLOGICAL DISEASE COMORBIDITY FLAG	27.21	0.0001
PERIPHERAL VASCULAR DISEASE COMORBID FLAG	6.28	0.0974
MALNU/DEHYD/ELECT IMBALANCE COMORB FLAG	4.79	0.1392
DEPRESSION COMORBIDITY FLAG	-3.55	0.5124
INCONTINENCE COMORBIDITY FLAG	47.08	0.0001
PARALYSIS COMORBIDITY FLAG	-13.47	0.0675
COPD COMORBIDITY FLAG	1.76	0.5024
COMORBID DISEASES HINDER WOUND HEALING	18.94	0.0012
EYE AND EAR CARE	-55.38	0.0001
CARE FOLLOWING HIP SURGERY	-26.92	0.0001
CARE SERIOUS CARDIOPULMONARY CONDITIONS	-15.03	0.0001
CARE LESS SERIOUS CARDIOPULMONARY CONDS	-14.76	0.0004
CARE OF SERIOUS CANCER	-19.33	0.0001
CARE OF AN UNCOMPLICATED WOUND	-18.36	0.0009
CARE ACUTE, SERIOUS RESPIRATORY DISEASE	-18.41	0.0001
CARE NEUROMUSCULAR/DEGENERATIVE DISEASES	-2.31	0.7244
COMBINED OSTOMIES	-6.44	0.6779
COMPLICATED WOUND OR AMPUTATION	-6.20	0.1911
MENTAL DIFFICULTIES	-15.66	0.0231
URINARY TRACT PROBLEMS	-4.26	0.3415
INFECTION/ANTIBIOTICS ADMINISTRATION	-13.83	0.0379
FRACTURES AND SURGERIES	-22.39	0.0001

VARIABLE	ESTIMATED COEFFICIENT	PROBABILITY COEFFICIENT NOT EQUAL ZERO
MISCELLANEOUS	-20.84	0.0001
CARE LESS SERIOUS NEUROMUSCULAR/SKELETAL	-23.47	0.0001
CARE OF BACK DISORDER	-13.84	0.0067
MALNUTRITION/DEHYD/ELECTROLYTE IMBALANCE	-9.47	0.1487
CARE OF ANEMIA	-11.07	0.0599
CARE FOLLOWING A STROKE	-1.38	0.7369
CARE HYPERTENSION AND CEREBROVASC DISEASE	-8.70	0.0383
CARE OF PERIPHERAL VASCULAR DISEASE	-3.64	0.5931
CARE OF GASTROINTESTINAL DISORDERS	-22.83	0.0001
(DIABETIC CARE)	OMITTED CATEGORY	
IMPATIENT STAY 14 DAYS PRIOR TO EPISODE	-3.20	0.0592
SNF STAY 14 DAYS PRIOR TO EPISODE	4.13	0.2851
IP DAYS 6 MONTHS PRIOR TO EPISODE	0.38	0.0001
SNF DAYS 6 MONTHS PRIOR TO EPISODE	0.34	0.0036
HHA VISITS 6 MONTHS PRIOR TO EPISODE	1.84	0.0001
IP REIMB 6 MOS PRIOR EPISODE START/1000	-0.47	0.0001
SNF REIMB 6 MOS PRIOR EPISODE START/1000	0.42	0.3203
HHA REIMB 6 MOS PRIOR EPISODE START/1000	-12.40	0.0001
AREA CHARACTERISTICS:		
LARGE METRO, FRINGE	4.31	0.1252
MEDIUM METRO	4.09	0.1016
LESSER METRO	12.09	0.0002
NONMETRO, URBAN	9.91	0.0040
NONMETRO, LESS URBAN	6.00	0.1100
NONMETRO, THINLY POPULATED	6.22	0.3599
URBAN/RURAL CODE MISSING	-15.18	0.3038
(LARGE METRO, CORE)	OMITTED CATEGORY	
MEDICARE SNF BEDS PER MEDICARE BENE 1986	-0.06	0.4259
HOSPITAL OCCUPANCY RATE	-3.52	0.5962
HOSPITAL BEDS PER 1000 PERSONS >=65	-0.01	0.9095
PROPORTION/HOSP WITH GERIATRIC ACUTE CARE	1.26	0.7857
PROPORTION/HOSP WITH GERIATRIC ASSESSMENT	-4.60	0.2366
PROPORTION/HOSP WITH GERIATRIC CLINICS	9.09	0.1340
PROPORTION/HOSP WITH HOME HEALTH	-0.17	0.9509
# PHYSICIANS PER 10,000 PERSONS	-0.05	0.7390
#FT HSP BASD REG NURSE PER 10000 PERSONS	0.15	0.1207
#FT HSP BASD LIC NURSE PER 10000 PERSONS	0.01	0.9554
#FT HSP BASD PHYS THER PER 10000 PERSONS	-3.28	0.1151
#FT HSP BASD OCCU THER PER 10000 PERSONS	-4.05	0.1677
#FT HSP BASD SPCh PATH PER 10000 PERSONS	4.25	0.4016
PER CAPITA INCOME IN 1000S - 1990	-0.03	0.9172
MEAN MEDICARE REIMB PER BENEFICIARY 1990	1.00	0.5619
ARF MEDICARE REIMBURSE VARIABLE MISSING	20.04	0.7289
PROPORTION OF ELDERLY LIVING IN POVERTY	36.23	0.0786
# HH AGNCIES IN CNTY/PER 10000 BENEFICIARY	-0.04	0.3626
LNGTH INPAT STAY IN SHORT TERM GENL HOSP	-0.14	0.5513

TABLE B5A (CONTINUED)

VARIABLE	ESTIMATED COEFFICIENT	PROBABILITY COEFFICIENT NOT EQUAL ZERO

AGENCY CHARACTERISTICS:

FACILITY TYPE BINARY-HOSPITAL BASED	-4.93	0.0677
FACILITY TYPE BINARY-OTHER	1.00	0.7103
FACILITY BAS-COMBINE GOVDL/REHBAS/SNFBAS	10.21	0.1223
FACILITY TYPE VARIABLE MISSING	38.63	0.0043
(FACILITY TYPE BINARY-VNA)	OMITTED CATEGORY	
PROFIT STATUS BINARY-GOVERNMENT	-7.48	0.0049
PROFIT STATUS BINARY-PROPRIETARY	14.28	0.0001
(PROFIT STATUS BINARY-NONPROFIT)	OMITTED CATEGORY	
MEDICARE CERTIFIED ONLY BINARY	-2.59	0.2934
MEDICARE CERTIFIED VARIABLE MISSING	-12.75	0.0566
(MEDICARE/MEDICAID CERTIFIED)	OMITTED CATEGORY	
YEARS IN OPERATION AT EPISODE START	-0.03	0.7936

SAMPLE SIZE   19,764

TABLE B5B
ESTIMATED COEFFICIENTS FOR TOBIT, EPISODE LENGTH IN DAYS

VARIABLE	ESTIMATED COEFFICIENT	PROBABILITY COEFFICIENT NOT EQUAL ZERO
GEOGRAPHIC REGION BINARY-NEW ENGLAND	20.67	0.0003
GEOGRAPHIC REGION BINARY-MID ATLANTIC	-13.64	0.0026
GEOGRAPHIC REGION BINARY-EAST NO CENTRAL	10.72	0.0144
GEOGRAPHIC REGION BINARY-WEST NO CENTRAL	-4.79	0.3938
GEOGRAPHIC REGION BINARY-EAST SO CENTRAL	53.10	0.0001
GEOGRAPHIC REGION BINARY-WEST SO CENTRAL	8.76	0.0822
GEOGRAPHIC REGION BINARY-MOUNTAIN	-7.46	0.2446
GEOGRAPHIC REGION BINARY-PACIFIC	-7.66	0.1063
(GEOGRAPHIC REGION BINARY-SOUTH ATLANTIC)	OMITTED CATEGORY	
EPISODE STARTED IN YEAR 1990 - BINARY	2.85	0.1875
PATIENT CHARACTERISTICS:		
SEX BINARY- 1=FEMALE 0=OTHERWISE	5.52	0.0152
RACE BINARY - 1=WHITE 0=OTHERWISE	-10.26	0.0010
AGE BINARY - AGE 0 TO 64	4.25	0.4564
AGE BINARY - AGE 75 TO 84	0.10	0.9724
AGE BINARY - AGE GE 85	5.44	0.0799
(AGE BINARY - AGE 65 TO 74)	OMITTED CATEGORY	
DEMENTIA COMORBIDITY FLAG	4.33	0.5433
CANCER COMORBIDITY FLAG	-7.78	0.1075
CHF COMORBIDITY FLAG	9.99	0.0142
DIABETES COMORBIDITY FLAG	7.02	0.0390
NEUROLOGICAL DISEASE COMORBIDITY FLAG	34.82	0.0001
PERIPHERAL VASCULAR DISEASE COMORBID FLAG	1.95	0.7300
MALNU/DEHYD/ELECT IMBALANCE COMORB FLAG	10.07	0.0368
DEPRESSION COMORBIDITY FLAG	-3.02	0.7086
INCONTINENCE COMORBIDITY FLAG	48.01	0.0001
PARALYSIS COMORBIDITY FLAG	-20.11	0.0672
COPD COMORBIDITY FLAG	6.64	0.0891
COMORBID DISEASES HINDER WOUND HEALING	11.88	0.1722
EYE AND EAR CARE	-117.23	0.0001
CARE FOLLOWING HIP SURGERY	-60.12	0.0001
CARE SERIOUS CARDIOPULMONARY CONDITIONS	-26.08	0.0001
CARE LESS SERIOUS CARDIOPULMONARY CONDS	-27.45	0.0001
CARE OF SERIOUS CANCER	-47.00	0.0001
CARE OF AN UNCOMPLICATED WOUND	-43.81	0.0001
CARE ACUTE, SERIOUS RESPIRATORY DISEASE	-32.66	0.0001
CARE NEUROMUSCULAR/DEGENERATIVE DISEASES	-20.54	0.0356
COMBINED OSTOMIES	-9.70	0.6751
COMPLICATED WOUND OR AMPUTATION	-32.68	0.0001
MENTAL DIFFICULTIES	-23.09	0.0247
URINARY TRACT PROBLEMS	7.22	0.2791
INFECTION/ANTIBIOTICS ADMINISTRATION	-48.05	0.0001
FRACTURES AND SURGERIES	-53.83	0.0001

VARIABLE	ESTIMATED COEFFICIENT	PROBABILITY COEFFICIENT NOT EQUAL ZERO
MISCELLANEOUS	-38.78	0.0001
CARE LESS SERIOUS NEUROMUSCULAR/SKELETAL	-48.56	0.0001
CARE OF BACK DISORDER	-43.29	0.0001
MALNUTRITION,DEHYD,ELECTROLYTE IMBALANCE	-20.40	0.0370
CARE OF ANEMIA	22.71	0.0092
CARE FOLLOWING A STROKE	-18.47	0.0025
CARE HYPERTENSION AND CEREBROVASC DISEASE	-19.88	0.0015
CARE OF PERIPHERAL VASCULAR DISEASE	-26.55	0.0090
CARE OF GASTROINTESTINAL DISORDERS	-40.29	0.0001
(DIABETIC CARE)	OMITTED CATEGORY	
IMPATIENT STAY 14 DAYS PRIOR TO EPISODE	-17.80	0.0001
SNF STAY 14 DAYS PRIOR TO EPISODE	4.85	0.4001
IP DAYS 6 MONTHS PRIOR TO EPISODE	0.41	0.0001
SNF DAYS 6 MONTHS PRIOR TO EPISODE	0.34	0.0537
HHA VISITS 6 MONTHS PRIOR TO EPISODE	1.57	0.0001
IP REIMB 6 MOS PRIOR EPISODE START/1000	-0.69	0.0002
SNF REIMB 6 MOS PRIOR EPISODE START/1000	-0.25	0.6933
HHA REIMB 6 MOS PRIOR EPISODE START/1000	-4.71	0.2565

AREA CHARACTERISTICS:

LARGE METRO, FRINGE	10.90	0.0094
MEDIUM METRO	11.21	0.0026
LESSER METRO	23.76	0.0001
NONMETRO, URBAN	20.97	0.0001
NONMETRO, LESS URBAN	29.12	0.0001
NONMETRO, THINLY POPULATED	33.61	0.0009
URBAN/RURAL CODE MISSING	-12.95	0.5572
(LARGE METRO, CORE)	OMITTED CATEGORY	
MEDICARE SNF BEDS PER MEDICARE BENE 1986	-0.36	0.0018
HOSPITAL OCCUPANCY RATE	15.75	0.1120
HOSPITAL BEDS PER 1000 PERSONS >=65	0.10	0.2158
PROPORTION/HOSP WITH GERIATRIC ACUTE CARE	-11.49	0.0966
PROPORTION/HOSP WITH GERIATRIC ASSESSMENT	-4.95	0.3936
PROPORTION/HOSP WITH GERIATRIC CLINICS	17.98	0.0465
PROPORTION/HOSP WITH HOME HEALTH	3.49	0.3863
# PHYSICIANS PER 10,000 PERSONS	-0.23	0.2788
#FT HSP BASD REG NURSE PER 10000 PERSONS	0.32	0.0285
#FT HSP BASD LIC NURSE PER 10000 PERSONS	0.11	0.7078
#FT HSP BASD PHYS THER PER 10000 PERSONS	-6.39	0.0397
#FT HSP BASD OCCU THER PER 10000 PERSONS	-4.88	0.2657
#FT HSP BASD SPCH PATH PER 10000 PERSONS	4.36	0.5646
PER CAPITA INCOME IN 1000S - 1990	-0.08	0.8430
MEAN MEDICARE REIMB PER BENEFICIARY 1990	-0.15	0.9522
ARF MEDICARE REIMBURSE VARIABLE MISSING	-39.19	0.6502
PROPORTION OF ELDERLY LIVING IN POVERTY	167.93	0.0001
# HH AGNCIES IN CNTY/PER 10000 BENEFICIARY	-0.13	0.7319
LNGTH INPAT STAY IN SHORT TERM GENL HOSP	-0.71	0.0506

VARIABLE	ESTIMATED COEFFICIENT	PROBABILITY COEFFICIENT NOT EQUAL ZERO
AGENCY CHARACTERISTICS:		
FACILITY TYPE BINARY-HOSPITAL BASED	-9.33	0.0205
FACILITY TYPE BINARY-OTHER	-0.52	0.8965
FACILITY BAS-COMBINE GOVOL/REHBAS/SNFBAS	15.29	0.1211
FACILITY TYPE VARIABLE MISSING	69.88	0.0005
(FACILITY TYPE BINARY-VNA)	OMITTED CATEGORY	
PROFIT STATUS BINARY-GOVERNMENT	-6.68	0.0916
PROFIT STATUS BINARY-PROPRIETARY	6.55	0.0518
(PROFIT STATUS BINARY-NONPROFIT)	OMITTED CATEGORY	
MEDICARE CERTIFIED ONLY BINARY	-9.92	0.0070
MEDICARE CERTIFIED VARIABLE MISSING	-20.83	0.0371
(MEDICARE/MEDICAID CERTIFIED)	OMITTED CATEGORY	
YEARS IN OPERATION AT EPISODE START	0.18	0.3372
SAMPLE SIZE	19,764	

TABLE B.6

UNADJUSTED AND REGRESSION-ADJUSTED MEAN HOME HEALTH VISITS PER DAY

			Adjusted for Episode Start Year, Plus:		
Region	Unadjusted Mean	Adjusted for Episode Start Year	Patient Characteristics	Patient and Area Characteristics	Patient, Area, and Agency Characteristics
Number of Visits per Episode Day					
New England	.57	.57	.57	.56	.58 ns
Middle Atlantic	.50	.50	.49	.47	.51
East North Central	.44	.44	.45	.43	.44
West North Central	.47	.47	.47	.49	.50
South Atlantic[a]	.61	.61	.61	.62	.59
East South Central	.50	.50	.50	.56	.53
West South Central	.55	.55	.55	.58	.55
Mountain	.59	.59 ns	.60 ns	.60 ns	.59 ns
Pacific	.50	.51	.51	.48	.49
All Regions	.53				
Standard Deviation of Means	.06	.06	.06	.07	.05
Number of Episodes	19,764				

SOURCES: Medicare 40 Percent Home Health Bill Records (1990-1992); Medicare National Claims History, Standard Analytical Files (1989-1992); Medicare Provider of Services files (1990-1992); Area Resource File (1993).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

The sample used to estimate the models described in this table is a 5-percent random sample of all database episodes that started in 1990 or 1991, less a small number of cases for which control variables were missing.

Ordinary least squares was used to estimate the regression models in this table.

Regression-adjusted, region-specific means were computed as follows:

For the reference region, South Atlantic (SA):

$$Mean_{SA} = Mean_{overall} - (b_1 * prop_1 + b_2 * prop_2 + ... + b_8 * prop_8)$$

For the other regions:

$$Mean_i = Mean_{SA} + b_i$$

where $i = 1,8$ for each of the eight regions other than South Atlantic, the b_i are ordinary least squares coefficients, and the $prop_i$ are the proportions of episodes from each of the regions.

[a] South Atlantic region is the reference region for the regression models.

ns = Difference in means between this region and South Atlantic is not statistically significant (at the .05 level, two-tailed test).

TABLE B.7

UNADJUSTED AND REGRESSION-ADJUSTED MEAN HOME HEALTH USE BY REGION
(DIABETES AS PRIMARY DIAGNOSIS)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic[a]	East South Central	West South Central	Mountain	Pacific	Standard Deviation (Overall Mean)
Number of Visits per Episode										
Unadjusted Mean	64	37	45	41	63	108	94	63	38	25 (64)
Adjusted for Episode Start Year and Truncation	69 ns	39	51	46	68	123	101	65	39	29
Adjusted for Episode Start Year, Patient, Area, Agency, and Truncation	88	50	58 ns	59 ns	65	98	88	75 ns	56	17
Episode Length (Days)										
Unadjusted Mean	116	83	131	115	129	231	173	100	70	49 (136)
Adjusted for Episode Start Year and Truncation	120	85	135 ns	118	134	243	180	103	71	52
Adjusted for Episode Start Year, Patient, Area, Agency, and Truncation	139	93	137	115 ns	113	172	131	106 ns	100	24
Number of Visits per Episode Day										
Unadjusted Mean	.55	.47	.41	.44	.53	.40	.49	.58	.54	.06 (.48)
Adjusted for Episode Start Year	.55 ns	.47	.41	.43	.53	.40	.49	.58	.54 ns	.07
Adjusted for Episode Start Year, Patient, Area, and Agency	.54 ns	.46	.40	.46	.52	.45	.50 ns	.56	.48	.05
Number of Episodes	1,514	3,841	4,265	1,449	5,536	3,858	3,566	860	2,225	27,114

SOURCE: Medicare 40 Percent Home Health Bill Records (1990-1992); Medicare National Claims History, Standard Analytical Files (1989-1992); Medicare Provider of Services files (1990-1992); Area Resource File (1993).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Patients with diabetes were identified using a classification system that groups principal diagnoses into categories according to the types and amount of home health care to which they typically give rise. (See Exhibit A.1 for a list of all 46 categories generated by the system.) The sample used to estimate the models described in this table is composed of episodes that started in 1990 or 1991 and for which Diabetic Care was the classification category for the principal diagnosis.

Tobit was used to estimate the regression models for episode length and number of visits per episode; ordinary least squares (OLS) was used to estimate models of visits per day.

Regression-adjusted, region-specific means were computed as follows:

For the reference region, South Atlantic (SA):

$$Mean_{SA} = Mean_{overall} - (b_1 * prop_1 + b_2 * prop_2 + ... + b_8 * prop_8)$$

For the other regions:

$$Mean_i = Mean_{SA} + b_i$$

where $i=1,8$ for each of the eight regions other than South Atlantic, the b_i are tobit or OLS coefficients, and the $prop_i$ are the proportions of episodes from each of the regions.

[a] South Atlantic region is the reference region for the regression models.

ns = Difference in means between this region and South Atlantic is not statistically significant (at the .05 level, two-tailed test).

TABLE B.8

UNADJUSTED AND REGRESSION-ADJUSTED MEAN HOME HEALTH USE BY REGION
(SERIOUS CARDIOPULMONARY CONDITION AS PRIMARY DIAGNOSIS)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	Standard Deviation (Overall Mean)
Number of Visits per Episode										
Unadjusted Mean	49	25	33	29	50	91	62	37	23	22 (42)
Adjusted for Episode Start Year and Truncation	50 ns	25	34	30	51	95	64	38	23	23
Adjusted for Episode Start Year, Patient, Area, Agency, and Truncation	64	38	43	39	48	80	57	46 ns	37	14
Episode Length (Days)										
Unadjusted Mean	96	61	96	89	92	186	131	80	57	39 (93)
Adjusted for Episode Start Year and Truncation	98 ns	61	97	90 ns	93	191	133	81	57	41
Adjusted for Episode Start Year, Patient, Area, Agency, and Truncation	123	80	111	95 ns	92	150	113	92 ns	84	22
Number of Visits per Episode Day										
Unadjusted Mean	.49	.44	.39	.38	.60	.47	.47	.49	.44	.06 (.47)
Adjusted for Episode Start Year	.49	.44	.39	.38	.60	.47	.47	.49	.44	.06
Adjusted for Episode Start Year, Patient, Area, and Agency	.49	.46	.39	.42	.56	.50	.48	.50	.44	.05
Number of Episodes	2,828	8,629	7,232	2,693	9,166	3,201	4,001	1,308	4,569	43,627

TABLE B.8 *(continued)*

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Patients with serious cardiopulmonary conditions were identified using a classification system that groups principal diagnoses into categories according to the types and amount of home health care to which they typically give rise. (See Exhibit A.1 for a list of all 46 categories generated by the system.) The sample used to estimate the models described in this table is composed of episodes that started in 1990 or 1991 and for which Care for Serious Cardiopulmonary Conditions was the classification category for the principal diagnosis.

Tobit was used to estimate the regression models for episode length and number of visits per episode; ordinary least squares (OLS) was used to estimate models of visits per day.

Regression-adjusted, region-specific means were computed as follows:

For the reference region, South Atlantic (SA):

$$Mean_{SA} = Mean_{overall} - (b_1 + b_2 * prop_2 + ... + b_8 * prop_8)$$

For the other regions:

$$Mean_i = Mean_{SA} + b_i$$

where $i = 1,8$ for each of the eight regions other than South Atlantic, the b_i are tobit or OLS coefficients, and the $prop_i$ are the proportions of episodes from each of the regions.

[a] South Atlantic region is the reference region for the regression models.

ns = Difference in means between this region and South Atlantic is not statistically significant (at the .05 level, two-tailed test).

TABLE B.9

UNADJUSTED AND REGRESSION-ADJUSTED MEAN HOME HEALTH USE BY REGION
(STROKE-SERIOUS NEUROMUSCULAR CONDITION AS PRIMARY DIAGNOSIS)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	Standard Deviation (Overall Mean)
Number of Visits per Episode										
Unadjusted Mean	89	.44	54	50	69	122	93	68	34	28 (64)
Adjusted for Episode Start Year and Truncation	92	45	57	52	72	130	96	70	35	30
Adjusted for Episode Start Year, Patient, Area, Agency, and Truncation	104	51	59	59	67	100	79	76 ns	52	20
Episode Length (Days)										
Unadjusted Mean	120	79	110	104	110	186	145	101	66	35 (108)
Adjusted for Episode Start Year and Truncation	124	80	112 ns	106 ns	113	193	148	103 ns	67	37
Adjusted for Episode Start Year, Patient, Area, Agency, and Truncation	139	93	119	104 ns	106	147	123	104 ns	90	20
Number of Visits per Episode Day										
Unadjusted Mean	.67	.58	.52	.51	.66	.63	.63	.65	.57	.06 (.60)
Adjusted for Episode Start Year	.67 ns	.58	.52	.50	.66	.64	.63	.65 ns	.57	.06
Adjusted for Episode Start Year, Patient, Area, and Agency	.69 ns	.57	.51	.55	.66	.65 ns	.62	.68 ns	.57	.06
Number of Episodes	1,615	4,720	4,405	1,576	5,856	2,170	2,642	1,002	3,878	27,864

TABLE B.9 *(continued)*

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

Patients with stroke or serious neuromuscular or degenerative conditions were identified using a classification system that groups principal diagnoses into categories according to the types and amount of home health care to which they typically give rise. (See Exhibit A.1 for a list of all 46 categories generated by the system.) The sample used to estimate the models described in this table is composed of episodes that started in 1990 or 1991 and for which Care following a Stroke or Care of Serious Neuromuscular and Degenerative Diseases was the classification category for the principal diagnosis.

Tobit was used to estimate the regression models for episode length and number of visits per episode; ordinary least squares (OLS) was used to estimate models of visits per day.

Regression-adjusted, region-specific means were computed as follows:

For the reference region, South Atlantic (SA):

$$Mean_{SA} = Mean_{overall} - (b_1 + b_2 * prop_2 + ... + b_8 * prop_8)$$

For the other regions:

$$Mean_i = Mean_{SA} + b_i$$

where $i = 1.8$ for each of the eight regions other than South Atlantic, the b_i are tobit or OLS coefficients, and the $prop_i$ are the proportions of episodes from each of the regions.

[a]South Atlantic region is the reference region for the regression models.

ns = Difference in means between this region and South Atlantic is not statistically significant (at the .05 level, two-tailed test).

TABLE B.10

UNADJUSTED AND REGRESSION-ADJUSTED MEAN HOME HEALTH USE
TREATMENT PLAN DATA SUBSAMPLE
(Episodes Starting in 1991)

			Adjusted for:		
Region	Unadjusted Mean	Patient Characteristics	Patient and Area Characteristics	Patient, Area, and Agency Characteristics	Patient, Area, and Agency Characteristics and Treatment Plan Data
Number of Visits per Episode					
New England	60	63	66	71	72
Middle Atlantic	33	33	35	39	39
East North Central	37	38	40	41	41
West North Central	34	36	38	40	42
South Atlantic[a]	54	52	52	49	48
East South Central	87	82	75	70	67
West South Central	65	63	55	52	51
Mountain	49	50 ns	53 ns	52	47 ns
Pacific	34	36	41	40	41
All Regions	48				
Standard Deviation	18	17	14	13	12
Episode Length (Days)					
New England	92	96	109	111	115
Middle Atlantic	66	69	79	79	81
East North Central	91	91 ns	98	97	94
West North Central	82	84	81	82	86
South Atlantic[a]	93	91	88	88	91
East South Central	164	157	132	130	124
West South Central	120	116	95	94	90 ns
Mountain	83	85	85 ns	86 ns	84
Pacific	69	73	88 ns	88 ns	90 ns
All Regions	93				
Standard Deviation	30	27	17	16	15
Number of Episodes	154,778				

SOURCES: Medicare 40 Percent Home Health Bill Records (1990-1992); Medicare National Claims History, Standard Analytical Files (1990-1992); Medicare Provider of Services files (1991); Area Resource File (1993); Regional Home Health Intermediary (RHHI) database (1991).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare home health claims that were preceded and followed by at least a 30-day hiatus in billing.

The sample used to estimate the models described in this table are home health episodes starting in 1991 that matched to the RHHI database.

Ordinary least squares (OLS) was used to estimate the regression models in this table.

Regression-adjusted, region-specific means (episode length or number of visits per episode) were computed as follows:

For the reference region, South Atlantic (SA):

$$Mean_{SA} = Mean_{overall} - (b_1 + b_2 \cdot prop_2 + ... + b_8 \cdot prop_8)$$

126

TABLE B.10 *(continued)*

For the other regions:

$Mean_i = Mean_{SA} + b_i$

where $i = 1,8$ for each of the eight regions other than South Atlantic, the b_i are OLS coefficients, and the $prop_i$ are the proportions of episodes from each of the regions.

[a]South Atlantic region is the reference region for the regression models.

ns = Difference in means between this region and South Atlantic is not statistically significant (at the .05 level, two-tailed test).

PROBABILITIES OF PATIENT OUTCOMES, BY REGION, FOR 5-PERCENT SAMPLE USED IN
MULTIVARIATE MODELS OF OUTCOMES IN CHAPTER IV AND FULL SAMPLE
(Percentages)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
Inpatient Admission Within 30 Days of Episode End										
All Episodes Starting in 1990/91 and Complete by December 1992	23.2	22.8	23.9	22.2	20.9	26.0	23.8	20.6	19.6	22.4
5-Percent Random Sample of Episodes Starting in 1990/91 and Complete by December 1992	23.5	23.3	24.6	24.0	19.9	23.0	23.3	20.3	19.7	22.3
Died Within 30 Days of Episode End										
All Episodes Starting in 1990/91 and Complete by December 1992	11.6	10.7	13.2	11.4	12.3	16.3	13.6	11.9	11.6	12.4
5-Percent Random Sample of Episodes Starting in 1990/91 and Complete by December 1992	12.8	11.4	13.5	12.4	11.9	15.5	13.2	12.5	11.9	12.6
Home Health Readmission Between 31 and 60 Days After Episode End										
All Episodes Starting in 1990/91 and Complete by December 1992	13.3	8.9	10.4	8.8	10.8	19.3	13.5	9.1	8.4	11.0
5-Percent Random Sample of Episodes Starting in 1990/91 and Complete by December 1992	16.4	8.4	10.3	8.4	11.1	21.4	13.0	12.1	8.9	11.5
SNF Admission Within 30 Days of Episode End										
All Episodes Starting in 1990/91 and Complete by December 1992	3.5	2.9	5.2	6.5	3.3	4.7	4.4	6.6	5.3	4.3

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	All Regions
5-Percent Random Sample of Episodes Starting in 1990/91 and Complete by December 1992	3.7	2.7	4.9	5.6	3.3	5.0	4.3	6.1	5.8	4.3
Number of Episodes										
All Episodes Starting in 1990/91 and Complete by December 1992	26,684	66,360	58,298	23,570	77,748	30,890	36,697	14,588	49,103	383,938
5-Percent Random Sample of Episodes Starting in 1990/91 and Complete by December 1992	1,361	3,324	2,878	1,172	3,712	1,526	1,831	769	2,464	19,037

SOURCES: Medicare 40 Percent Home Health Bill Records (1990-1992); Medicare National Claims History, Standard Analytical Files (1989-1993).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare claims that were preceded and followed by at least a 30-day hiatus in billing.

TABLE B.12

UNADJUSTED AND REGRESSION ADJUSTED PROBABILITY OF PATIENT OUTCOMES BY REGION

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic[a]	East South Central	West South Central	Mountain	Pacific	Standard Deviation (Overall Mean)
Inpatient Admission Within 30 Days for Same Diagnostic Care Group as for Home Health										
Unadjusted Mean	5.1	6.3	5.1	5.7	3.8	4.7	5.1	5.1	4.7	.7 (5.0)
Adjusted for Episode Start Year, Patient, Area, and Agency	5.5	5.5	5.3	6.5	3.8	4.2 ns	5.0 ns	6.4	5.1	.9
Home Health Readmission Within 30 Days for Same Diagnostic Care Group as Original Episode										
Unadjusted Mean	10.6	4.2	6.1	4.7	5.8	13.8	8.2	7.5	4.2	3.2 (6.6)
Adjusted for Episode Start Year, Patient, Area, and Agency	12.1	6.1 ns	7.0 ns	4.8 ns	5.7	9.0	5.8 ns	5.4 ns	4.9 ns	2.4
Number of Episodes	1,361	3,324	2,878	1,172	3,712	1,526	1,831	769	2,464	19,037

SOURCES: Medicare 40 Percent Home Health Bill Records (1990-1992); Medicare National Claims History, Standard Analytical Files (1989-1992); Medicare Provider of Services files (1990-1992); Area Resource File (1993).

NOTE: For this study, episodes of home health care have been defined as periods covered by strings of Medicare claims that were preceded and followed by at least a 30-day hiatus in billing.

The sample used to estimate the models described in this table is a 5-percent random sample of all database episodes that started in 1990 or 1991 and that were complete prior to December 1992, less a small number of cases for which control variables were missing.

Logit was used to estimate the regression models in this table. Logit estimates regression models for which the dependent variable is a binary, rather than continuous, measure.

TABLE B.12 (continued)

Regression-adjusted, region-specific probabilities (Mean) were computed as follows:

For the reference region, South Atlantic (SA):

$$Mean_{SA} = Mean_{overall} - (b_1 \cdot prop_1 + b_2 \cdot prop_2 + ... + b_8 \cdot prop_8)$$

For the other regions:

$$Mean_i = Mean_{SA} + b_i$$

where $i = 1,8$ for each of the eight regions other than South Atlantic, the b_i are marginal impacts computed from logit coefficients, and the $prop_i$ are the proportions of episodes from each of the regions. To estimate the marginal impact that region i has on the probability of a binary outcome occurring, we compute for each episode (based on a logit model) the predicted probability of the event occurring, first assuming that it was provided by an agency in region i, and then assuming that it was provided by an agency in the reference region (South Atlantic). We then average the differences between these two predicted probabilities across all sample members to obtain the estimated effect of region i relative to the reference region.

[a] South Atlantic is the reference region for the regression models.

ns = Difference in means between this region and South Atlantic is not statistically significant (at the .05 level, two-tailed test).